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ON ETHYL CORPORATION FUEL WAIVER APPLICATION  
U.S. ENVIRONMENTAL PROTECTION AGENCY  
401 M Street, S.W.  
EDUCATION CENTER AUDITORIUM  
WASHINGTON, D.C. 20036

June 22, 1990

RS:

Wilson, Chairman  
Office of Mobile Sources

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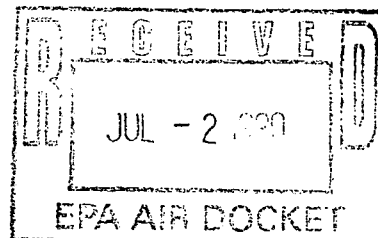
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WITNESSES:

Ellen Silbergeld  
Environmental Defense Fund

James Derderian, Representing  
Honorable Thomas J. Bliley, Jr.

Mr. Duncan, Representative for  
Honorable Richard H. Baker

Dewey Mark

Everett L. "Red" Hodges

John Donaldson  
Bio-Tox Resources

Ray Wilkins, Jr.  
Senior Vice President  
Ethyl Corporation

Gary Ter Haar  
Vice President, Health and Environment  
Ethyl Corporation

1 P R O C E E D I N G S 9:00 a.m.

2 CHAIRMAN WILSON: Good morning everybody. I'm  
3 Richard Wilson. I'm Director of the Office of Mobile  
4 Sources at the Environmental Protection Agency here. I'll  
5 chair today's hearing on the Ethyl Corporation's Fuel Waiver  
6 Application.

7 Welcome to the hearing. For the record, this hearing  
8 is convened on June 22, 1990 at 9:00 in the EPA Auditorium  
9 at EPA Headquarters, 401 M Street, SW, Washington, D.C.

10 The purpose of this hearing is to provide EPA with oral  
11 testimony regarding the recent application by Ethyl to  
12 utilize Hi Tec 3000, also known as MMT -- I'll avoid going  
13 through the chemical term, we'll get into that later -- as  
14 an additive to unleaded gasoline.

15 Statements by the participants will not be subject to  
16 cross examination by others who testify however the panel  
17 may ask participants questions concerning their statements.

18 The hearing will be conducted informally and technical  
19 rules of evidence will not apply. A written transcript of  
20 the hearing will be taken and anyone desiring to purchase a  
21 copy of the transcript should make individual arrangements  
22 with the Court Reporter reporting the proceedings.

23 The transcript will also be placed in the Public  
24 Docket, No. A-90-16 of the Air Docket of EPA and copies of  
25 the transcript as well as other pertinent documents may be

1 viewed and copied at the Air Docket which is located in the  
2 mall area of the EPA Headquarters Building here.

3 For the record I'd like to clarify the status of these  
4 proceedings. Section 211(f)(1) of the Clean Air Act, as  
5 amended in 1977 makes it unlawful after March 31, 1977 to  
6 introduce into Congress any fuel or fuel additive for use in  
7 light duty motor vehicles manufactured after 1974 which is  
8 not substantially similar to fuels or additives utilized to  
9 certify model year 1975 or subsequent model year engines.

10 Section 211(f)(4) of the Clean Air Act provides  
11 application by any fuel or fuel additive manufacturer, the  
12 Administrator of EPA may waive the prohibitions of Section  
13 211(f)(1) if the Administrator determines that the applicant  
14 has established that such fuel or fuel additive will not  
15 cause or contribute to the failure of vehicles to meet the  
16 standards to which they have been certified.

17 If the Administrator does not act to grant or deny a  
18 waiver within 180 days of receipt of the application, in  
19 this case by November 5, 1990, the statute provides that the  
20 waiver shall be treated as granted.

21 The current submission by Ethyl is an application under  
22 Section 211(f)(4) of the Act for a waiver to blend MMT in  
23 unleaded gasoline, resulting in a level of .03125 or 1/32nd  
24 of a gram per gallon manganese.

25 This is Ethyl's third application for waiver for MMT.

1 Ethyl's first application was submitted on March 17, 1978  
2 for concentrations of MMT resulting in 1/16th and 1/32nd  
3 gram per gallon manganese in unleaded gasoline.

4 Ethyl's second application was submitted on May 22,  
5 1981 for concentrations of MMT resulting in 1/64th gram per  
6 gallon manganese in unleaded gasoline.

7 The Administrator denied these requests for waivers  
8 primarily due to increased hydrocarbon exhaust emissions  
9 associated with the use of MMT.

10 If the prohibitions against MMT were waived by the  
11 Administrator, it is highly likely that most U.S. gasoline  
12 would contain some level of MMT and therefore it is also  
13 highly likely that fuels used in certifying vehicles under  
14 Section 206 of the Act would be required to reflect this  
15 compositional change.

16 At this point I'd like to introduce other members of  
17 the panel here today. On my left, Mary Smith, Director of  
18 the Field Operations and Support Division. On her left,  
19 Margaret Gilhooley of the Office of General Counsel. Next  
20 to her, Dwight Atkinson of our Office of Policy, Planning  
21 and Evaluation. Next to him, David Kortum of the Field  
22 Operations Court Division and on my right, Ken Poirier or  
23 Environmental Criteria and Assessment, Office of EPA.

24 The Administrator's decision on this application for  
25 waiver will be made on the basis of the public record so we

1 encourage comments on Ethyl's waiver application and on  
2 today's presentation and now we'll begin the testimony from  
3 the various witnesses. Is Congressman Baker here?

4 (No Response.)

5 Is James Derderian here from Congressman Bliley's  
6 office? No? If not, we'll start with Ellen Silbergeld,  
7 Environmental Defense Fund.

8 MS. SILBERGELD: Thank you very much for the  
9 opportunity to comment on the application for a waiver by  
10 Ethyl Corporation for using MMT, Methylpentadine  
11 Meomanganese Trippardinalas a gasoline additive.

12 EDF submits these comments on this application at this  
13 time and we do intend to submit an expanded version of these  
14 comments before the close of the public comment period. The  
15 document that I've given to you is for purposes of the  
16 public hearing.

17 Over the past decade I've served on several EPA  
18 committees charged with assessing environmental fate,  
19 transport and health impacts of another organo metal  
20 gasoline additive also manufactured by Ethyl, that is  
21 tetraethyl lead.

22 Since receiving my doctorate from Johns Hopkins I've  
23 also actively conducted basic and clinical research on the  
24 effects of low level chronic exposure to both lead and  
25 manganese. While I was at NIH I provided expert opinion via

1 the Director of the Neurologic Institute to the government  
2 of Bolivia on the potential effects of manganese in drinking  
3 water.

4 More recently I served on the peer review panel for  
5 EPA's most recent health assessment document on manganese  
6 and I also reviewed the recent Health Effects Institute  
7 paper on the health effects of manganese as an additive to  
8 gasoline.

9 EDF strongly opposes granting this waiver application.  
10 The Clean Air Act provides that EPA, quote, "May", quote,  
11 "Grant a waiver allowing the use of manganese as a fuel  
12 additive upon determining that the additive will not impair  
13 emissions control devices such as the catalytic converter."

14 Regardless of the effects of MMT on emissions control,  
15 there is no dispute that manganese is neuro toxic to humans.  
16 It is on this basis that EPA should deny this waiver.  
17 Particularly since Ethyl has yet again failed to provide  
18 relevant or convincing evidence on two critical points.

19 One, that the use of MMT will not effect human health  
20 and two, that the use of MMT will not measurably add to the  
21 environmental loadings of manganese in critical compartments  
22 directly related to human exposure.

23 EDF believes that it would be a serious abrogation of  
24 EPA's clear responsibility under the Clean Air Act to  
25 protect human health of it were to do otherwise. In fact,



1       it's a rare opportunity to apply clear lessons of past  
2       experience to a very similar application.

3               To disregard these lessons, the lessons of the past 55  
4       years, by approving the wide spread and inherently  
5       dispersive use of another neuro toxic metal is to invite  
6       repetition of a public health catastrophe which we know now  
7       has been associated with the use of lead as a gasoline  
8       additive from 1925 to the present.

9               I need not document to you the epidemic status of  
10       childhood lead poisoning in the United States. This is  
11       clearly laid out in the 1988 ATSTR report to Congress and it  
12       is also quite clear of the important and significant role  
13       played by tetraethyl lead additives to gasoline in  
14       contributing to that epidemic.

15               This is an experience we cannot afford to repeat. The  
16       parallels between Ethyl's proposal in 1990 to use manganese  
17       and it's proposals from 1922 to '25 to use lead are rather  
18       chilling. In other cases the exclusive basis for this  
19       application was and is its purported effect on automotive  
20       efficiency and emissions of hydrocarbons and other  
21       pollutants from cars.

22               No data were submitted in 1922 and none are submitted  
23       now that are relevant or convincing on the potential  
24       cumulative health effects of massive inputs of a toxic metal  
25       into the environment, its deposition into surface dusts and

1       soils and its long-term fate and exposure pathways to  
2       humans.

3             In 1925 Ethyl argued that the amounts of lead to be  
4       added to gasoline were of negligible importance and that  
5       lead was only toxic at the high doses encountered in certain  
6       industrial settings.

7             In 1990 Ethyl argues that the releases of manganese to  
8       the environment will be insufficient and that manganese is  
9       only toxic at high doses in industrial settings. As Yogi  
10      Berra once said, deja vu all over again.

11            In both cases, Ethyl has suggested that acceptance of  
12      its additive is of critical importance to the nation. In  
13      1990, amazingly, Ethyl finds it unnecessary to do anything  
14      more than it did in 1925. Wholly inadequate data have been  
15      presented to you to indicate that adding manganese to  
16      gasoline will not change concentrations of manganese in  
17      ambient air over the short-term in some selected Canadian  
18      cities.

19            Ethyl does not cite a recent study from California and  
20      we have appended to our testimony an annotated bibliography  
21      including that report. A recent study from California which  
22      demonstrates that increases in airborne and deposited  
23      manganese are related to additions of manganese to gasoline  
24      already permitted by EPA.

25            No in-depth discussion of the health effects of

1 manganese is presented nor, more importantly, is there a  
2 discussion of the critical data gaps on manganese toxicity  
3 that must be filled before any decision can be approved that  
4 would result in tons of manganese released into the  
5 environment.

6 EPA must assert its leadership role in 1990 to defend  
7 the preventative impairment of its mandate to protect human  
8 health and the environment.

9 What's at stake here is not the health of emissions  
10 control devices and automobiles but the health of humans.  
11 This waiver cannot be approved until the applicant provides  
12 substantive information on the cumulative impacts of  
13 manganese additives on environmental quality and not solely  
14 ambient air concentrations and convincing evidence that such  
15 impacts will not adversely effect the health of any segment  
16 of the human population over the long term.

17 In making this case, Ethyl must demonstrate that the  
18 likely experience with manganese will not resemble that with  
19 lead. We expect that this will be difficult to show. Both  
20 lead and manganese are elements and as such, they will not  
21 degrade or quickly disappear from stable environmental  
22 compartments such as soils, dusts and sediments.

23 Patterns of use will result in relative enrichment in  
24 urban, densely populated areas with high levels of vehicular  
25 traffic and residential patterns such that persons are in

1 close contact with the areas most heavily impacted by  
2 fallout from vehicle emissions.

3 All of this we know from lead. Although the proposed  
4 per gallon use of manganese is less than the usage of lead  
5 in gasoline at its peak prior to regulation in 1978, the  
6 vastly increased amount of gasoline consumed and number of  
7 vehicle miles driven in the U.S. in 1990 as compared to the  
8 1920's will insure that the rate of contamination of our  
9 environment from this source will be comparable.

10 Both lead and manganese are neuro toxic metals. While  
11 the data on manganese is relatively sparse compared to lead  
12 -- but of course we haven't yet conducted massive human  
13 experiments with manganese -- that's what you're being asked  
14 to approve. The hazard identification of manganese as a  
15 neuro toxin and lung toxin is clear.

16 Manganese, like lead, is a cumulative toxin in that  
17 both its absorption and retention as well as its toxicity  
18 increase with time. At present there are insufficient data  
19 on the low level chronic sequelae of manganese exposure,  
20 similar to the case that was made for lead in 1925.

21 There are no data on the effects of manganese on the  
22 aging brain although there is good reason to believe that  
23 the nature of manganese-induced patho-physiology, that is,  
24 damage to the nigrostriatal neuronal system of the brain, is  
25 such that a positive, worrying interaction with normal cell

1       loss during senescence would be expected.

2               The potential for selective susceptibility to manganese  
3       in the aged must be of great concern as the U.S. population  
4       itself ages. Moreover, the possibility that iron deficiency  
5       may potentiate manganese toxicity and again, reference is  
6       cited in the attached bibliography, is of considerable  
7       concern, given the prevalence of iron deficiency in the  
8       United States.

9               The mechanisms by which manganese damages neural  
10       tissue, particularly neurons using catecholamines as  
11       transmitters, are unknown so that we cannot propose an  
12       overall dose response relationship or a rational basis for  
13       risk assessment.

14              There are inadequate studies on the immuno-toxic  
15       effects of MMT or manganese. The toxico kinetics of low  
16       dose manganese exposure are not known and there are puzzling  
17       differences between rodent and primate models.

18              Moreover, the expression of sever ape kinetic and neuro  
19       psychiatric symptoms in workers exposed to manganese are not  
20       clearly associated with increased concentrations of  
21       manganese in brain at autopsy, further indicating that the  
22       mechanisms as well as the toxico kinetics of manganese are  
23       not yet well understood.

24              We have no defined biological markers for manganese  
25       exposure in humans so that our interpretation of the

1 available epidemiologic studies is presently limited.

2 In summary, both what we know and do not know at  
3 present about the likely toxic effects of adding manganese  
4 in large total amounts to the environment must persuade EPA  
5 to reject this application.

6 We know that manganese at high dose is a demonstrated  
7 human neuro toxin with persistent and irreversible  
8 pathological effects on the brain structure and resulting  
9 severe impairments in movement and mental state.

10 We do not know what the long-term chronic low dose  
11 consequences of human exposure to manganese are. We do not  
12 know a, quote, "safe level" of manganese exposure,  
13 particularly for those subgroups that may be at increased  
14 risk for neuro toxicity, in this case, the aged.

15 We do not know if manganese is carcinogenic although  
16 there is evidence that it can break DNA. With respect to  
17 exposure assessment, on the other hand -- and this is very  
18 unusual in a situation where EPA must come to a judgement on  
19 inadequate data, incomplete data sets -- with respect to  
20 exposure assessment, we know a great deal based on our  
21 tragic experience with lead about the likely cumulative  
22 impacts of such a use upon human exposure to manganese.

23 We know that the gradual contamination of the  
24 environment by this additive will not be readily reversed,  
25 that manganese will accumulate in specific parts of the

1 environment, many of which are subject to intensive human  
2 interaction such as urban dusts and soils.

3 We know that manganese in air and in surface dusts and  
4 soils will present directly to humans as a source of  
5 exposure.

6 Ethyl has chosen to focus its application on the  
7 purported efficacy of manganese additives to reduce certain  
8 pollutant emissions from vehicles. In a well-known  
9 publicity campaign over the past week, Ethyl has sought to  
10 harness concerns over the impacts of these air pollutants on  
11 global and local air quality as justification for this  
12 application.

13 Ethyl has selectively cited bits of data in support of  
14 its contention that use of MMT will not increase manganese  
15 concentrations in air in cities. Ethyl has provided no data  
16 on the impacts of manganese additives on manganese  
17 concentrations in more stable post-deposition compartments  
18 such as dusts and soils.

19 Ethyl has provided no in-depth review of the data and  
20 data gaps on manganese toxicity and I might add that most  
21 expert reviewers of the Health Effects Institute Review came  
22 to the same conclusion about the inadequacy of paper as  
23 well.

24 In 1925 Ethyl introduced its new product, tetraethyl  
25 lead as, quote, "A gift of God." It has taken us over 50

1 years to realize how diabolical this gift has proven to be.

2 Reduction of lead in gasoline represents one of the  
3 most significant public health achievements of the EPA.  
4 You, Mr. Wilson, and others can take justifiable pride in  
5 participating in that.

6 Now, in 1990, Ethyl comes bearing yet another gift. To  
7 this offering, EPA should just say no. The purported  
8 benefits of reducing climatic impacts cannot be achieved  
9 upon the rack of an epidemic of manganism.

10 EDF urges rejection of this application and also  
11 immediate suspension of all permitted use of manganese as a  
12 gasoline additive in the United States.

13 CHAIRMAN WILSON: Thank you for your testimony.  
14 We have a few questions. Can you compare what the exposures  
15 -- environmental exposures to people would be from the use  
16 of this additive in relation to other sources of manganese?

17 MS. SILBERGELD: Yes. I would estimate that the  
18 exposures to manganese from this use would result in a  
19 general and wide spread increase in the exposures of the  
20 American public to manganese overall, therefore, on a  
21 population basis the average or median exposure of Americans  
22 to manganese would increase.

23 Compared to specific point sources or industrial  
24 exposures, of course, these exposures would be lower.  
25 However, they would be chronic and life-long and they would



1 be encountered by persons in all age groups and at all  
2 stages of nutritional sufficiency or deficiency.

3 Again, one can draw very close parallels with our  
4 experience with lead in that of course there are  
5 occupational settings were exposures to workers and others  
6 are much more intensive to lead then they are in the general  
7 environment. Nevertheless, 55 years of the use of lead as  
8 an additive has substantially increased the median and  
9 individual body burdens of lead in the American public.

10 We know this in both the prospective and retrospective  
11 sense, as I'm sure you're aware. That is, by studying  
12 various tissue repositories we know that in the period from  
13 1925 to 1975, body burdens of lead have increased enormously  
14 and these can only be ascribed to a general wide spread and  
15 dispersive source.

16 We also know that in the period of time when we started  
17 to take lead out gasoline we also succeeded in taking lead  
18 out of children's bodies.

19 CHAIRMAN WILSON: Ethyl argues in its application  
20 a couple points on the pro environment and I guess pro  
21 health side. One is that this additive would lower the  
22 emissions of at least carbon monoxide and nitrogen oxide.

23 They also argue that it would provide octane in a way  
24 that would allow refiners to, if they chose, use less other  
25 constituents in the gasoline that perhaps themselves are

1 toxic, for example, aromatics.

2 Do you have a comment on the potential trade off here  
3 between the beneficial uses of the additive versus the  
4 problems?

5 MS. SILBERGELD: Well, with respect to the  
6 purported beneficial uses, which I think are still a matter  
7 for some examination by the EPA, has a toxicologist I would  
8 comment that as a general rule the dispersion of a stable  
9 element that is toxic in the environment has potentially  
10 much more far-reaching and adverse economic and health costs  
11 than the disbursal of a relatively short-lived aromatic or  
12 other kind of contaminant.

13 MR. POIRIER: In your statement you primarily seem  
14 to be concerned with oral exposure of manganese. Do you  
15 have a comment on inhalation as well at this point?

16 MS. SILBERGELD: No. I'm not primarily concerned  
17 about oral exposure. I'm concerned about releases that will  
18 first enter the ambient local air environment but I expect  
19 that the post emission behavior of manganese in an oxide or  
20 whatever other form it leaves the automobile will closely  
21 resemble that from lead and that the post deposition  
22 exposure routes will include some inhalation but also  
23 include injection as this material becomes mixed in dusts  
24 and soils, contaminates surface water and the food supply.

25 MR. POIRIER: Thank you.

1 MS. SMITH: Ethyl states in its application that  
2 it tried to measure the amount of manganese coming out of  
3 the tailpipe and that it's something like one half of one  
4 per cent of what's going in. If these assertions are true,  
5 are your concerns still as great as your testimony  
6 indicates?

7 MS. SILBERGELD: Well, first off I was told that  
8 by Dr. Ter Haar also and I find that inherently a somewhat  
9 puzzling statement just from the point of view of mass  
10 balance of physics.

11 It may be that Ethyl is claiming that only a small per  
12 cent of this additive will leave the tailpipe as MMT and in  
13 that case it would resemble what is known about ...  
14 tetraethyl lead, that in fact in the combustion process most  
15 of it does end up being emitted in inorganic form as an  
16 oxide or a halide so that if that is the contention of  
17 Ethyl, that's probably true.

18 Let me state quite clearly, my concern is not with MMT,  
19 that is with manganese as an organo metal although there are  
20 substantial concerns about that compound.

21 My concern is about the accumulation of manganese as  
22 manganese. Moreover, if in fact much of the manganese  
23 remains in the car which is a statement that has yet to be  
24 proven not to be ... at some point that manganese  
25 accumulation will enter the environment through the waste

1 stream or some other source and as EPA knows, for instance,  
2 the disposal of used oil has proven to be a very difficult  
3 issue because of contamination by lead.

4 MR. ATKINSON: Can you give me some information  
5 about the relative health effects of injection versus  
6 inhalation? For example, I took a vitamin this morning. I  
7 looked on the back of the bottle. It had two and a half  
8 milligrams of manganese in it -- as manganese sulfate -- and  
9 in preparing for the hearing I found out that bananas and a  
10 number of spices and so forth have a lot of manganese in it.  
11 Why are we not so concerned with that type of injection? Or  
12 should we be?

13 MS. SILBERGELD: Manganese is an essential trace  
14 element and is very critical, particularly during  
15 development so that, unlike lead, a case cannot be made that  
16 any exposure to this metal represents some increment of  
17 risk.

18 However, loadings of the environment, increasing the  
19 chronic exposures, particularly in persons long past  
20 development, may have significant toxic effects even at  
21 doses that for the developing organism are entirely part of  
22 ordinary metabolism and trace mineral metabolism.

23 With respect to your question about the oral versus  
24 inhaled dose, it is somewhat difficult to extract these  
25 issues from the available epidemiologic evidence but in so

1 far as one can, in circumstances where there is an  
2 opportunity for inhalation dose such as in primary smelters  
3 and ferro manganese alloying industries, there appear to be  
4 effects of manganese on the lung which may result from  
5 direct interaction of manganese entering the uvular pathway.

6 MR. ATKINSON: That's separate from your neuro  
7 toxicological effects?

8 MS. SILBERGELD: That is separate from the neuro  
9 toxic effects. Neuro toxic effects are also expressed in  
10 persons in similar industries but it appears that in  
11 inhalation circumstances the lung becomes a critical target  
12 organ.

13 When injection appears to be the sole route of exposure  
14 -- and these are primarily these studies of manganese in  
15 drinking water -- then lung involvement is not  
16 characteristically seen but there may be some suppression of  
17 the immune system and neuro toxic effects.

18 MRS. WHITE: I think that's all the questions.  
19 Thank you very much for your testimony. I understand Mr.  
20 Derderian has arrived. How are you?

21 MR. DERDERIAN: Good morning, Mr. Chairman,  
22 Panelists. I'm James Derderian, Legislative Director for  
23 The Honorable Thomas J. Bliley. A scheduling conflict did  
24 not permit the Congressman to be here in person so I'd like  
25 to read his statement for the record.

1           "I appreciate this opportunity to provide my views on  
2 the waiver application by Ethyl Corporation for permission  
3 to use their fuel additive, Hi Tec 3000 in unleaded  
4 gasoline.

5           "I'm interested in this proceeding for two reasons.  
6 First, I am the Congressman that represents the Headquarters  
7 of Ethyl Corporation and the health and welfare of my  
8 constituents are important.

9           "More importantly, as a long-term member of the  
10 Subcommittee on Health and Environment and the Committee on  
11 Energy and Commerce, I've been involved in the public policy  
12 debate over clean air legislation for 10 years.

13           "The issue involved in this waiver applications are the  
14 same ones as we've been debating in our committee for years  
15 and of course the same ones on which we've been negotiating  
16 in the current revision of the Clean Air Act.

17           "Hopefully we will conclude this very important bill in  
18 the next few weeks and have it ready for the President's  
19 signature shortly thereafter.

20           "In this legislation we're trying to take another step  
21 forward to clean up our air. Among other things, we're  
22 tightening tailpipe standards, we're attempting to foster  
23 cleaner fuels and we're establishing new restrictions on  
24 stationary sources of pollution.

25           "Major opposition to these and other provisions in the

1 bill comes largely from interests that must bear the high,  
2 high cost of making these changes.

3 "I think it is important to note that the subject of  
4 this hearing is a product that will help accomplish all  
5 three of these objectives that I just mentioned. It will  
6 reduce tailpipe emissions by 7.8 per cent, the most notable  
7 component of this reduction is NOx, which is cut by 20 per  
8 cent.

9 "Secondly, it will help the refiners clean up gasoline.  
10 Its octane producing property will allow the refiner to meet  
11 octane requirements without including some of the more  
12 noxious and controversial components such as benzene and  
13 other aromatics.

14 "In addition, for the same reason, it allows the  
15 refiner to reduce the vapor pressure of gasoline, which has  
16 been a long sought goal of the subcommittee.

17 "Finally, because it allows the refiners to reduce the  
18 process severity, it will allow them to reduce their  
19 stationary source emissions.

20 "What I find so attractive about this product is that  
21 it can do all of these things in an economical way. We in  
22 Congress do not have to legislate its use. We do not have  
23 to fund it or subsidize it. If buyers at the wholesale or  
24 retail level do not want to use it, they don't have to. But  
25 it helps them lower tailpipe emissions and it saves them

1 money.

2 "If we had more options like this one, improving air  
3 quality would be a much easier job. As you know, Mr.  
4 Chairman, my purpose is not to endorse a product but to  
5 highlight its importance in terms of public policy, reducing  
6 tailpipe emissions, especially NOx and producing cleaner  
7 gasolines and end point source emissions.

8 "I've certainly been impressed by the potential  
9 environmental benefits of this product and I urge you and  
10 the panel's strongest consideration of this waiver  
11 application. Sincerely, The Honorable Thomas J. Bliley."

12 CHAIRMAN WILSON: Thank you. I understand Mr.  
13 Duncan, representing Congressman Baker is here?

14 MR. DUNCAN: Good morning.

15 CHAIRMAN WILSON: Good morning.

16 MR. DUNCAN: Thank you for the opportunity to  
17 represent Congressman Baker this morning. He also had  
18 obligations back in the District and was unable to be here  
19 this morning. And I'll also read you the statement that he  
20 wrote last night.

21 "Good morning. I'm Congressman Richard Baker from the  
22 6th District of Louisiana. My District includes Baton Rouge  
23 which is the location of the headquarters of Ethyl  
24 Corporation's chemical group. It is also the location of a  
25 number of other chemical and petroleum operations.



1 "I'm very happy to testify on behalf of one of my  
2 constituents. What really motivates my support of this fuel  
3 waiver application for Hi Tec 3000, though, is the benefit  
4 this product offers our community.

5 "Like many cities around our country, Baton Rouge  
6 suffers from ozone episodes. Already we in Baton Rouge have  
7 formed a taskforce made up of industry, state and local  
8 government to develop a plan to reduce the frequency and  
9 severity of these episodes.

10 "In view of this, I'm quite interested to learn the  
11 Ethyl Corporation was attempting to obtain approval from the  
12 EPA to market a product that would reduce automobile  
13 emissions of nitrogen oxide by 20 per cent.

14 "Since nitrogen oxide is a primary contributor to the  
15 ozone problems, use of this product would have a substantial  
16 benefit for Baton Rouge. A reduction of nitrogen oxide  
17 emissions of this size may allow our city to avoid taking  
18 other corrective actions that are more costly and less  
19 effective.

20 "When I think about the many other cities around the  
21 country that also suffer from ozone problems, the potential  
22 benefit of this product for air quality is significant. In  
23 addition to helping improve air quality, this product has a  
24 very important economic benefit.

25 "Since it produces octane, it reduces the need to

1 process crude oil. Ethyl estimates this could save over 30  
2 million barrels of crude oil each year. This is roughly one  
3 half billion dollars that would not be spent for imported  
4 oil each year.

5 "Since it is compatible with reformulated fuels, it can  
6 play a very important role in reducing air pollution both  
7 now and in the future.

8 "I know there are many technical issues that EPA must  
9 consider before passing judgement on this application but I  
10 want to reiterate some very important practical ones.

11 "Baton Rouge has a problem today and this product can  
12 help us today and it can do so without imposing additional  
13 costs or any other burdens on any of our citizens.

14 "In closing, I think we need to have these kinds of  
15 products available as we work to find a solution to our air  
16 pollution problems both locally and nationally. The quality  
17 of our lives and the very future of our planet depends on  
18 our availability to meet the goal of environmental  
19 protection in a responsible manner.

20 "I believe that we must find ways of solving the global  
21 environmental problems while satisfying the world's growing  
22 energy needs and I believe that products such as Hi Tec 3000  
23 can help achieve both goals.

24 "Thank you for your time and consideration of this very  
25 important matter. If I can provide you with any additional

1 information, please feel free to contact me."

2 CHAIRMAN WILSON: Thank you very much and please  
3 express our thanks to Congressman Baker for his paper.

4 MR. DUNCAN: Thank you.

5 CHAIRMAN WILSON: The next witness will be Dewey  
6 Mark. Good morning.

7 MR. MARK: Good morning, Dick. How are you? It's  
8 nice to see you again. Mr. Chairman and members of the  
9 Panel, I've provided you with copies of a rather brief  
10 prepared statement. I don't intend to read it. I think  
11 I'll just visit with you a little bit about this issue.

12 You know, there's an old saying that what goes around  
13 comes around. Strange as it may seem, 11 years ago, in  
14 1979, the refining industry was beginning to seriously feel  
15 the impact of the Iranian revolution.

16 The EPA in the previous September had suspended the use  
17 of what we then called MMT or Hi Tec 3000. I was privileged  
18 to be on a taskforce that was ... by Tenico requesting that  
19 EPA permit us to use this additive in unleaded gasoline  
20 during the summer of '79 because the industry was faced with  
21 potential shortages, particularly of premium gasolines.

22 The EPA granted such a waiver. I believe Mr. Doug  
23 Costle was the Administrator at that time. I find it rather  
24 ironic that I'm here 11 years later urging that the EPA this  
25 time grant the use of this additive in unleaded gasoline.

1           I have spent 38 years in this business, I recently  
2           retired as president down in Shamrock Refining and  
3           Marketing, a medium sized independent company. I'm  
4           immediate past president of the National Petroleum Refiners  
5           Association so I think I am reasonably well qualified to  
6           address this issue from a refining standpoint.

7           I said that the industry in 1979 suffered the results  
8           of a revolution and I'd suggest to you that the refining  
9           industry is on the threshold of now even another revolution  
10          and that is primarily in the specifications of gasoline.

11          The refiner's continuing challenge for many years has  
12          been to have adequate octanes to meet the ever-increasing  
13          appetite that the automobile manufacturers impose upon us  
14          and for quite a number of years we had access to tetraethyl  
15          lead.

16          That has since and perhaps wisely been eliminated from  
17          our recipe there, so to speak. As we see what's happening  
18          now, we're loosing octane by virtue of RVP reduction.  
19          Primarily because we must remove a significant portion of  
20          butane from our motor pool and this is being continued to be  
21          lowered.

22          We have no idea where the bottom is going to be. It's  
23          going to be interesting to see if you can run automobiles in  
24          Bangor, Maine on seven pound gasoline but it might be tested  
25          even. So we're loosing octanes by reduction of ...

1           Obviously, when you see the debate that's gone on on  
2           the Hill in the last few months, there is a continued effort  
3           to reduce the aromaticity of gasoline. This has proven to  
4           be a great source of octanes through the years, due  
5           primarily to the reforming process.

6           So we're going to loose octanes by having to reduce the  
7           aromaticity. And lastly, there's a very -- a rather subtle  
8           double edged sword that's coming and that is we think  
9           there's no question that the end point of gasoline, the  
10          final boiling point of gasoline will be lowered.

11          Most of the gasolines in this country have an end point  
12          of around 425 degrees fahrenheit. We anticipate that this  
13          might drop to as low as 350 or 370 degrees and in so doing  
14          you're going to loose a significant portion of the  
15          hydrocarbon barrel which contains, in that portion, a fair  
16          amount of xylene which is a very high octane blend stock.

17          So that's the reason I suggest to you that the refining  
18          industry is on the threshold of another revolution. It is  
19          very difficult today, even in the refining business, to  
20          intelligently budget your capital requirements for the  
21          future, mainly because reformulated gasoline is an unknown  
22          entity.

23          It gets a lot of play in the media, it gets a lot of  
24          lip service on the Hill but if you're a refiner and you're  
25          trying to know what kind of capital you've got to request

1 for facilities that are going to take you two to two and a  
2 half years to build, the decision must be made today and you  
3 don't even know what the damned gasoline is going to look  
4 like because there's so many people trying to influence the  
5 recipe, so to speak.

6 I think that the approval of Hi Tec 3000 is extremely  
7 important to the refining industry as a whole. I think also  
8 that it has a particularly important significance to the  
9 small and medium sized refiner.

10 When you get up to looking at the cost of octanes in  
11 the 87, 89, 92 range, one extra octane number is extremely  
12 expensive but it's also extremely important to remain  
13 competitive.

14 There's no question that due to the pricing structure  
15 that's been established for this additive, previously  
16 unleaded in the country and also for its wide spread use in  
17 Canada for the last 10 years, that it is truly a competitive  
18 source of octanes and it's primarily on this basis that I  
19 would urge that the EPA give consideration once again to  
20 approving the use of this additive. Thank you very much for  
21 your time.

22 CHAIRMAN WILSON: Thank you very much, Mr. Mark.  
23 While we're visiting maybe we can get your advice on how we  
24 should proceed. I think obviously this additive is  
25 attractive in many ways. It's an effective way of

1 increasing octane and apparently has the effects of lowering  
2 emissions of nitrogen oxide and perhaps carbon monoxide as  
3 well.

4 Unfortunately, we never find an issue that doesn't have  
5 some cons as well as pros and as you mentioned, we've been  
6 through some of these issues in the past, like lead, where  
7 perhaps it would have been better had we never gone down  
8 that path at all.

9 We've heard already from Ms. Silbergeld this morning  
10 about her concerns about the introduction of manganese in  
11 the environment, another heavy metal. The additive does  
12 appear to increase hydrocarbon emissions slightly.

13 Also we'll be hearing, if not today, I'm sure written  
14 comments, concerns about the impact on ... of deposits of  
15 this and what's your advice on how we should weave our way  
16 through these issues and make a considered judgement?

17 MR. MARK: Well, Mr. Wilson, I think that one of  
18 the things that we should not be blind to is the extensive  
19 use over 10 years of this product in Canada, at, as I  
20 understand it, a dosage level twice of what is being  
21 requested in this waiver.

22 I think that the EPA should use its intergovernmental  
23 contacts to the fullest extent to get our Canadian friends  
24 to share their experience with us.

25 I don't know anything that's better than 10 years of

1 experience as opposed to people sitting around and  
2 speculating about what if. You know, any issue, anything  
3 that comes up, somebody is going to say what if. Then  
4 you've got to measure the probability of that what if and  
5 then you've got to measure the cause and effect of that what  
6 if.

7 I'm always reminded of -- it's a redundant story, but  
8 the Alaska Pipeline. We had people worrying well, what if  
9 the caribou won't walk under the pipeline? They raised it,  
10 it was in the air. There are more caribou in Alaska today  
11 then there were 15 years ago but the net effect of that, it  
12 delayed that project -- that and others -- delayed that  
13 project by eight or nine years and just ran the cost up  
14 astronomically. So I would urge you to be very dependent  
15 upon the Canadian experience in this case.

16 MR. ATKINSON: I have another question or two for  
17 you, Sir. One of the goals, if you look at the House and  
18 Senate versions of the Clean Air Act are that -- you  
19 mentioned the recipe, one of the items in the recipe is to  
20 lower aromatics.

21 The oxygenates have gotten a great deal of attention  
22 for, among other reasons -- a number of reasons but for one  
23 reason in particular, to offer as a substitute for the  
24 octane that would be lost if we were to lower the aromatics.

25 With the octane potential of MMT or Hi Tec 3000, if you



1       prefer, what do you believe the competition effects would be  
2       on MTBE, ethanol, some of the oxygenates?

3               MR. MARK: I guess the place to start from is the  
4       first oxygenate that was used by the United States refining  
5       industry was MTBE, not ethanol. It was MTBE. It was  
6       introduced because it could be produced and was more than  
7       competitive with tyraquine which was an old-time aromatic  
8       octane enhancer, if you would.

9               As time has passed, a number of the western states,  
10       particularly, have imposed a minimum level of oxygen in the  
11       gasoline, particularly during the winter months. So MMT and  
12       ethanol have afforded an opportunity to meet those oxygen  
13       requirements, which was independent of an octane imposition.  
14       It was strictly an oxygen containing issue.

15              My own conviction is that if EPA grants this waiver,  
16       MMT will be put into the blending stream first, along with  
17       straight run and other blend stuffs that go into it and then  
18       the oxygenates will be used along with whatever aromatics  
19       are permissibly useable to attain the ultimate octane.

20              So I think a refiner would be stupid, due to the  
21       competitive advances, not to use it first and use it to his  
22       fullest -- you grant a 32nd of a gram, then use a 32nd of a  
23       gram. And then they'll finish off with either oxygenates  
24       and/or aromatics.

25              The oxygenates are not the final answer. Believe me.

1 You've still got to have other sources of octane to meet an  
2 87 or 89 octane product. You just can't do it with  
3 oxygenates.

4 Ethanol, for example, is 10 per cent. MTBE is limited  
5 by your waiver to 15 per cent. So you can't make an 87 or  
6 89 octane gasoline just resorting to octane enhancement by  
7 oxygenates.

8 MR. ATKINSON: In Canada I'm told that virtually  
9 every drop of gasoline has MMT in it -- or every gallon.  
10 What I'm hearing and you seem to think that will be the  
11 situation in this country also with this waiver, is that  
12 true?

13 MR. MARK: I think the economic advantage of the  
14 use of it will drive it in that direction. I think some of  
15 the testimony that has been presented in the written form  
16 indicates that the cost of this additive is around eight to  
17 ten cents per octane barrel.

18 I can tell you my own first hand experience in  
19 refining, that our cost of an octane barrel for reforming is  
20 a minimum of about 25 cents a barrel and I think on an  
21 average of the industry it runs about 35 cents a barrel.

22 So as a refiner, a guy would be stupid not to use a 10  
23 cent a barrel octane source as opposed -- he can lower the  
24 severity of his reforming and that is money in his pocket.  
25 Plus the fact he would get an increase of liquid product

1       yield if he can reduce it.

2               See, in the reforming process you actually destroy a  
3       portion of your feed stock. A portion of it is converted to  
4       very light hydrocarbons that either are recovered or they go  
5       into the ... system.

6               Well, now, if you can change the amount of liquid  
7       product that is produced by reforming by not having to  
8       resort to higher severity to get those extra octanes, then  
9       you're ahead of the game. Does that make sense?

10              MR. ATKINSON: Yes. Thank you.

11              CHAIRMAN WILSON: Thank you very much for joining  
12       us. It's good to see you again.

13              MR. MARK: Thank you, Mr. Wilson. It's good to be  
14       with you again.

15              CHAIRMAN WILSON: The next witnesses are Mr.  
16       Everett Hodges and Dr. John Donaldson.

17              MR. HODGES: Mr. Chairman, I think I'll lead off  
18       here. My name is Everett L. "Red" Hodges. I'm an  
19       independent oil producer from the state of California. My  
20       interest is from some research that I started sponsoring  
21       about six years ago in the state of California so I want to  
22       kind of give you a story of the history of the reason I'm  
23       here and why my interest has developed around manganese and  
24       manganese compounds.

25              My wife and I have four children, three are adopted and

1 one of these adopted kids was hyperactive and out of  
2 control. This was about seven years ago. So I read an  
3 article in Science News where some researchers out of Argon  
4 National Laboratories up in Chicago had stated that they  
5 were able to discern that aberrant behavior could be  
6 detected using sophisticated equipment and hair analysis and  
7 with toxic loads of heavy metals they were able to do a  
8 significant comparison of people that were normal versus  
9 hyperactive people.

10 So I called them up and being an independent oil  
11 producer in 1979 and the price of crude oil was about \$25 a  
12 barrel out in California so I was a hell of a lot smarter  
13 now that it's down to \$9 and \$10 a barrel.

14 But I figured since I've got the cash flow and I want  
15 to fix this kid of mine because he was giving me a lot of  
16 trouble, I'd sponsor a research project and I was sitting on  
17 a foundation with some professors at the University of  
18 California, Irvine, notably, Dr. Lewis Gottchalk who has  
19 written 850 scientific peer reviewed articles and published  
20 45 books and I was told that if you're ever going to do any  
21 double blind research to prove whether or not the theory of  
22 these guys is going to pay off, you have to get a world  
23 class scientist.

24 So I asked Louie if he'd be the lead agent and I'd talk  
25 to these fellows at Argon and they said well, they'd gone so

1 far but they had no more research funds, therefore I offered  
2 to sponsor the program. Gottchalk said yes. He said I'll  
3 set up a protocol and we'll do the job and I said what I'm  
4 really after, Louie, is do these fellows have something with  
5 regard to being able to detect severe mineral imbalances,  
6 chemical imbalances by a simple non-invasive use of hair so  
7 that you can discern that people with -- providing this  
8 service to a doctor, let's say, could know what the problem  
9 is if somebody had aberrant behavior.

10 So he said sure, I'll sponsor the deal. He said quite  
11 frankly, Red, he said, you're trying to tell me that there's  
12 a physiological marker for violence or aberrant behavior and  
13 he said, let me tell you something, I've raised \$30 million  
14 for the university and done these 800 articles and you're  
15 trying to tell me that there's a subclass of people and that  
16 if you were to discover that there was some kind of a marker  
17 for aberrant behavior, it would put a question on scientific  
18 research on all of the scientific, physiological studies  
19 that have ever been done.

20 I said well, I don't know what I'm saying but I want to  
21 spend the money. He said well, Hodges, you're pissing your  
22 money away but that's okay, let's go for it. I said all  
23 right, let's go for it.

24 So he sets up the protocol. We go -- Dr. Bill Walsh  
25 out of Argon National Laboratories had a friend by the name

1 of Schoenthaler who had access to the prison system and  
2 obtained access of hair samples of 100 criminals in this  
3 prison system. I had a Superior Court Judge that collected  
4 those hair samples along with 50 controls that they mixed up  
5 and the judge held the keys to the code. UCI came down and  
6 just got the 150 hair samples but didn't get the keys to the  
7 code, went back, put in 50 more hair samples, mixed them all  
8 up, recoded them, gave them to the Superior Court Judge who  
9 held the key to the code and then forwarded the hair samples  
10 of approximately 200 to Argon National Laboratories who then  
11 recoded it again and sent it off to Doctors Data which is a  
12 commercial laboratory in Chicago that does hair analysis.

13 The results come back, five to one. Gottchalk says  
14 Hodges, this is bullshit. I say why do you mean? He says  
15 this is impossible. Hair is no good although by then I knew  
16 there was two thousand scientific articles on hair alone  
17 just on lead. Peer reviewed. But these guys don't know  
18 about this stuff.

19 So he said this is impossible and he says I can't write  
20 a publication. I said well, I paid the university \$25  
21 thousand for the protocol, what do you mean you can't write  
22 a publication? He said I didn't allow for violent guys  
23 outside the institution and it's quite obvious that these  
24 heavy contaminants are coming from the institution. They're  
25 eating out of pots and pans loaded with heavy metals.

1           So he said I'm sorry, I can't write. I screwed up, but  
2   you know, you're wasting your money. Well, I knew that two  
3   sheriffs in Los Angeles and San Bernardino County, Fred  
4   Bland and Sherman Block and I had been communicating with  
5   him.

6           Gottchalk went with me, we went up and saw Sherman  
7   Block who has 20 thousand people in jail and the thrust was  
8   this. Since he's alleging that there is an institution  
9   factor in the hair because they are locked up, let's get  
10  guys that just were committed a week or two ago of violent  
11  criminal behavior and get them and get their hair sample  
12  right then.

13          So we paid these criminals and these violent guys \$10 a  
14  piece. They'll kill for that. And we got hair samples from  
15  the two different jails. In came the hair samples directly  
16  from the two jails to the department of psychiatry. They  
17  went out and got 30 controls, mixed them all up, sent them  
18  back to Argon who coded them, came back six to one.

19          Now Gottchalk is having a problem. As you can imagine  
20  this guy, he's 65 years of age, he's spent millions of  
21  dollars and here he's finding that there is a subclass of  
22  people that seemed to have some kind of overloads of metals  
23  accumulated in the body.

24          Well, he says, I can't do anything about it. He says,  
25  I've got to publish. So we call the guys at Argon National

1       Laboratories. They sent down a formula and their formula  
2       wasn't working. It might have worked in Chicago when they  
3       did their work but it didn't work in California.

4               The guy was telling me in essence, well, it takes a  
5       trained eye to find out, usually, to look on these hair  
6       analysis. You've got one there on a mass murderer and you  
7       can see how aberrant these scales are of these guys that are  
8       violent.

9               So I've got a computer jock in the office with me. I  
10      also spend to money on a computer hotshot deal. He put all  
11      these hair analysis on his computer and he was asking the  
12      computer what element is it of the 30 different elements  
13      that they analyzed which is one standard deviation high in  
14      all three of the studies, the two jails and the prison and  
15      it came up manganese.

16              I said manganese. He says yeap. Lead doesn't count,  
17      cadmium doesn't count but he says manganese in all three of  
18      the studies.

19              I go over to Gottchalk, I said Gottchalk, manganese is  
20      the only one that's one standard deviation high. He says  
21      Hodges, this is a post-doc finding. We'll have to go back  
22      to jails but we'll now have a protocol. We predict that  
23      there will be a significant number of violent individuals  
24      with one standard deviation high of manganese which is .7 of  
25      one part per million versus controls and we were running six



1 to one at this point in time.

2 We go back to jail, he picks up 30 hair samples with  
3 the Department of Pharmacology, a guy by the name of Pasio  
4 Rubello, comes back, goes out and gets 60 controls, mixes  
5 them all up, sends them back, it comes back six to one  
6 manganese.

7 Now Gottchalk has got the sign. He's a christian.  
8 He's a believer. And by the way, I'll give you a copy. He  
9 just submitted a journal -- a paper to be submitted and  
10 printed in the Journal of Neural Toxicology.

11 Following this, Sherman Block in Los Angeles County  
12 asked me to go down and get -- no. I asked him if I could  
13 go get some other hair samples out of the state of  
14 California. The jail in Houston, Texas, gets hair samples  
15 of 30 individuals -- and by the way, on these first four  
16 studies -- the first three studies, one-third were black,  
17 one-third were hispanic and one-third were caucasian so  
18 there were 155, all races were balanced. The 30 with the  
19 protocol of manganese was all caucasian so we went down and  
20 got all black in the San Bernardino Jail. In the Houston  
21 Jail 80 per cent had one standard deviation of manganese.

22 I went down into the Louisiana jail system, 45 per cent  
23 Louisiana. Not as high as the rest of them. But I didn't  
24 get controls.

25 I'm doing this stuff and I'm reading articles about

1 manganese intoxication. By the way, I don't have a degree  
2 in anything. But I'm freely espousing now on criminal  
3 justice, psychiatry, the court systems in research.

4 Following this, I'm reading these articles and the name  
5 John Donaldson keeps cropping up with regard to  
6 neurotoxicology so I called Donaldson. This was  
7 approximately a year ago. I give him this story about what  
8 we're finding out here in California.

9 Donaldson says my god, so that's it. He doesn't  
10 remember this but I remember this and I said what's that.  
11 He said Mr. Hodges, I'm sending you an article where the  
12 national government of Australia noted that there was a  
13 significant incidence of violence on an island off the north  
14 part of the country, out in one of the oceans and he says  
15 they went out there and did a manganese study but they were  
16 sent out there because of violence. It's the world's  
17 largest manganese mine. Groote Eylandt. Incidents two,  
18 three -- a hundred per cent higher than the basic continent  
19 of violence and that's why they sent Dr. Countenter out  
20 there.

21 You have before you there a list of documents that I've  
22 put some roman numerals on. The first one is Senate Bill  
23 107, State of California has passed a law that allowed  
24 biomedical research in the Northern California Youth  
25 Authority. The Governor signed this by virtue of this

1 research work.

2 The next one is a four page summary of the research  
3 signed by Dr. Gottchalk and Robello at the University of  
4 California which in essence gives you a rundown on the study  
5 and the double blind of the four criminal justice systems.

6 The next one is a news article on Patrick Purdy, who is  
7 a mass murdered. We got his hair sample. Patrick Purdy, he  
8 -- the State Attorney's office got the hair sample. They  
9 sent it directly to Doctors Data. He had two and a half  
10 standard deviations high in manganese. There's his hair  
11 analyses. You can see he's extremely overloaded on all the  
12 metals. That's number four.

13 Number five is using hair as a diagnostic tool to  
14 compliment blood serum and urine. The next is an excerpt  
15 from this book here I'll give you. This is Manganese in the  
16 Canadian Environment. It's published by Canada. Most of it  
17 has Donaldson's work in it.

18 The last one is a judge five years ago got hair  
19 analysis on 16 juveniles in Louisiana, 15 of 16 had one  
20 standard deviation high on manganese and over half of them  
21 had two standard deviations high.

22 I don't want to shoot Ethyl in the foot but I don't  
23 want to be blind sided. As far as I'm concerned, from the  
24 research that I've done here, there's a lot of research that  
25 has to be done. It's primarily with primates. Pregnant

1       primates, by the way, because from Donaldson's work and  
2       others, manganese can go right through to the fetus.

3               However, there can be a -- it looks as though there's a  
4       class of people that have a propensity to grab on to all  
5       heavy metals including manganese and it can be genetic and  
6       it isn't going to take much to prove or disprove it.

7               If this is the case, you can see that it wouldn't make  
8       any difference where the manganese came from, these people  
9       just grabbed on to it. It was pointed out here that over 50  
10      per cent of the people, kids in the inner city are deficient  
11      in iron. If you're deficient in iron, the gut grabs on to  
12      -- guess what? Manganese. The first thing it grabs onto  
13      and it puts it into the body.

14              Donaldson will get into the technical aspects of what  
15      happens when manganese gets into the body but as far as I'm  
16      concerned, the effects of manganese and what's been taking  
17      place has been sorely and pathetically overlooked by the  
18      Environmental Protection Agency.

19              You people are dealing with a time bomb. Unfortun-  
20      ately, the time bomb has a tenant 30 year fuse on it because  
21      if people from the research generate this and it causes  
22      early deterioration of the basal ganglia and ... and it  
23      doesn't happen until 50 and 60 years of age but it's taken  
24      place by virtue of an overload of manganese, then the EPA  
25      and the school lunch programs ought to see that iron is

1       supplemented in the lunch meals to get these kids so that  
2       they're not grabbing on to manganese.

3               That pretty well does it. I think that the EPA should  
4       get on this, study it in depth, sponsoring the necessary  
5       programs to find out what manganese is doing. It's a very  
6       insidious metal but it's a very interesting metal and one  
7       thing that's fascinating to me is that manganese 2 which is  
8       relatively inert in the human brain can change as valencies  
9       to manganese 3. If that takes place, it becomes a highly  
10      neuro degenerative chemical and if it's destroying portions  
11      of the brain it is ascertainable by using primates and  
12      getting on a double blind cross over study.

13              So I just -- as far as I'm concerned, I think the Ethyl  
14      Corporation can't -- look at, I'm in the oil business. I'm  
15      all for selling oil. In fact, if you know anybody that  
16      wants to buy about three thousand barrels a day of  
17      California heavy high sulphur crude, have I got a deal for  
18      you.

19                      (Laughter.)

20              In fact, if you want to buy that, I have a bridge I'd  
21      like to sell you, too. I'd just like to see the EPA move on  
22      this very cautiously. The state of California, through  
23      Senator Bob Presley, who is Senator of the State Finance  
24      Committee but also in charge of prisons, looked at this and  
25      assigned it with scientists for five straight years before

1 he introduced his legislation.

2 When he got on the floor of the Senate and Assembly  
3 there was only one vote against it in the Assembly and none  
4 in the Senate. I mean, it breezed through there. You  
5 couldn't get into the California system to do this neuro --  
6 these kinds of studies, the supplementation studies and use  
7 hair and blood for 10 solid years it had been outlawed.  
8 They're serious now.

9 Of course, California is like everybody else, we've got  
10 90 thousand guys in the prison system. We have 10 thousand  
11 kids in the California Youth Authority, 50 per cent of them  
12 ... within 24 months. They cost the taxpayers a million  
13 dollars a piece.

14 If we've found physiological marker for violence, even  
15 if the manganese doesn't cause the violence but it's a  
16 marker that is associated on a five or six to one ratio,  
17 then I'm claiming that we've got the world's first  
18 physiological marker.

19 Now, every institution that we've been in that they  
20 have controlled and nobody has touched these samples except  
21 the University of Southern California or the judge or  
22 Donaldson in Australia, is coming up with a manganese marker  
23 in violence.

24 The question mark, it may or may not be the cause but  
25 there's certainly something there and I'm looking for a

1 situation where we can go in and do an investigation where  
2 the manganese isn't a marker and I've challenged a half  
3 dozen prisons but the bureaucracy doesn't even want to  
4 bother with it.

5 I think right now manganese is the name of the game.  
6 The Ethyl Corporation has got something that would be of  
7 great benefit from the standpoint of energy saving by  
8 decreasing consumption of oil but they need to do some more  
9 basic research so that they can get on with finding out as  
10 to whether or not it's a certain class of people. It  
11 doesn't matter whether they get it in water, which people  
12 get intoxicated with water, dust from mining or from food,  
13 you can pick up manganese from a lot of different areas and  
14 it doesn't make any difference where it's coming from, you're  
15 going to get it and therefore it could be that it's not a  
16 matter of ... but as far as I'm concerned, the EPA should  
17 walk very cautiously before they make a decision to approve  
18 this.

19 Now I don't need to introduce John Donaldson but he was  
20 appointed by the Canadian government to investigate and  
21 comment with regard to manganese in the environment. He's  
22 published throughout the world and I've asked John to come  
23 here today because he can handle the technical aspects of  
24 the manganese question. Thank you.

25 CHAIRMAN WILSON: Thank you.

1 DR. DONALDSON: Good morning Ladies and Gentlemen.  
2 You know, when I first began acquainted with manganese back  
3 in the '60's, the first thing that I recall was the  
4 definition, actually, which comes from the origins of the  
5 ancient greek manganin which means voo-doo or cult, black  
6 magic.

7 After about 25 years experience with manganese which as  
8 excited me, frustrated me, which has lead along the golden  
9 path of many promises and provocative glimpses of the  
10 underlying biogenesis only to feed me with really what  
11 amounted to fraudulent rhetoric where I was once again  
12 dashed to the ground again when I thought I had the answer  
13 to this extremely provocative metal element.

14 I'd like to set the stage, if I may, actually, for my  
15 acquaintance with manganese. This was in the laboratory of  
16 Dr. Andre Barbeau at the University of Montreal where I  
17 became Director of Research on the task which had been set  
18 to us, actually the underlying issue of Parkinson's Disease.

19 It's difficult to reconcile manganese without also  
20 understanding a little bit about Parkinson's Disease. I'd  
21 like perhaps this morning to go into that a little bit and  
22 all you can really fully comprehend the underlying mysteries  
23 of this most remarkable element.

24 The story of the manganese, the old story and the new  
25 story is a fascinating saga and has really yet to be told



1 but at that time, actually, we were working on trying to  
2 find a drug which would cure Parkinson's Disease.  
3 Parkinson's Disease, as many of you probably know, is  
4 exhibited by facial stiffness, rigidity, tremors and through  
5 ultimately the work of Dr. Hornykiewicz in Vienna and other  
6 neuropathologists at the University of Vienna, we discovered  
7 that there was a deficiency of the neuro hormone dopamine --  
8 dihydroxyphenylalanine, dopamine -- so many efforts were  
9 made around the world to try and find a way to replenish the  
10 dopamine in the basal ganglia, a region which was deficient  
11 in dopamine.

12 It was quickly found that dopamine itself would not  
13 cross the formidable blood brain barrier by which means  
14 chemicals are occluded from penetrating the brain for very  
15 obvious reasons.

16 Ultimately, we started to look for precursors of  
17 dopamine. Now, one of the precursors used widely today --  
18 still widely used after 25 years -- is dopa. This is a  
19 nutrient. Dopa, El Dopa is administered to patients as  
20 dihydroxyphenylalanine as a direct precursor of dopamine.  
21 This goes on, in the brain and replenishes the dopamine and  
22 the patient is directly benefited. There are other drugs  
23 now available which do essentially the same thing, to  
24 replenish the dopamine.

25 Our direct competitors in this were the very gifted

1 individual Dr. George Cotzias in the Brookhaven Laboratories  
2 and Dr. Cotzias, whom I admire very much, died in 1977. Dr.  
3 Barbeau died four years ago. It was well known in circles  
4 that both Dr. Barbeau and Dr. Cotzias, who had worked and  
5 been credited with the discovery of El Dopa, that they would  
6 have been awarded Nobel Prize, but this prize would have  
7 been awarded jointly rather than singly, so when Dr. -- when  
8 George Cotzias died, this sort of went by the board.

9 But this is to give you an idea of the -- very much the  
10 high intensity of research which was being conducted at that  
11 particular time in Montreal and in New York in the search  
12 for a cure for Parkinson's Disease.

13 As one does, one looks for clues, as an investigator  
14 and I'm a basic minster of neuroscientist. I was impressed  
15 with the work that Dr. George Cotzias had done on manganese.  
16 His studies had shown that in Chilean miners who had been  
17 exposed to manganese fumes in the mines, they came down with  
18 essentially what appeared to be the clinical signs of  
19 Parkinson's Disease.

20 In a case that went through autopsy they found that  
21 this individual exposed to manganese in the mines also had  
22 dopamine deficiency in the basal ganglia, the same reason as  
23 Parkinson's Disease.

24 This, to me, seemed a major clue in which to possibly  
25 unravel the mysteries of Parkinson's Disease. Here was a

1 metal element which could effect the brain to produce a  
2 certain methodology and a biochemical pathology of  
3 Parkinson's Disease so this is when my love affair began  
4 with manganese.

5 The other peculiar thing about manganese and left  
6 completely in the dark for many, many years was, unlike  
7 Parkinson's Disease, there was an acute face to manganese  
8 neurointoxication.

9 This was a peculiar, bizarre neuro-psychiatric  
10 symptomology which was exhibited by running, laughing,  
11 chasing after cars, very bizarre type of psychosis.  
12 Manganese psychosis. We gave it that title although we  
13 still don't know what it means but certainly very much in  
14 line with the origin, again, of manganin, the voo-doo. The  
15 name attributed by the Greeks to manganese. It's still very  
16 strange.

17 My first attempts to uncover the rational underlying  
18 the ability of manganese to cause insult to nervous tissue  
19 in a very remote area were fruitless for many years. The  
20 most puzzling thing was the fact that manganese administered  
21 to animals, despite the fact that it would locate in areas  
22 of the brain such as the cortex in very great amounts did  
23 not cause any damage.

24 For many years we wondered why animals did not make a  
25 good model for this thing until ultimately it was revealed

1       that primates could be used to determine the effects of  
2       manganese on an area called the substantianigra.

3               (Tape malfunction, information lost.)

4               ... discoloration, loss of the black melanin and  
5       pigment in the back of the brain and he knows without  
6       looking, almost without proceeding any further, this patient  
7       with Parkinson's Disease and he can always tell, with many  
8       years experience, of the degree of depigmentation the extent  
9       of the Parkinsonian symptoms that the patient actually had  
10      prior to death.

11              The depigmentation, the loss of pigment, the loss of  
12      melanin from the granules contained within the dopamine  
13      aryans, all the substantianigra, this region we now know is  
14      very intriguing. It contains the cells which synthesize  
15      dopamine. These fibers in the back of the brain then send  
16      up the dopamine to be stored in the basal ganglia, in the  
17      cardia putamen region of the basal ganglia. This area, as  
18      we mentioned, is diminished, is depleted in Parkinson's  
19      Disease and in manganese neurointoxication.

20              In a few studies in primates and one study in man and  
21      by personal observations by Dr. Hornylcienicz in Vienna, Dr.  
22      Hornylcienicz has told me and Dr. Hornylcienicz is one of  
23      the pioneers in Parkinson's research, he's one of the  
24      pioneers in the neuropharmacology along with Bertheimer and  
25      Jellinger in Vienna in neuropathology that manganese

1 neurointoxication is the ideal model for the study of  
2 Parkinson's Disease.

3       There is depigmentation, he tells me, loss of the  
4 melanin pigment, in the cells of the substantianigra, which  
5 of course would indicate also us having found loss also of  
6 the dopamine in the basal ganglia since the cells are  
7 destroyed that synthesize dopamine, it stands to reason that  
8 it's not going to be stored.

9       Barbeau, in 1962, published a paper in which he stated  
10 that Parkinson's Disease and possibly other neuro-  
11 degenerative disorders like Ametropic Lateral Sclerosis,  
12 Alzheimer's Disease, Huntington's Disease, possibly, were  
13 essentially disorders or exaggerated aging ...

14       ... above the basal ganglia, above the substantianigra  
15 is there is an age related decrease in destruction of these  
16 cells in substantianigra.

17       Approximately -- and there is some disagreement on  
18 this, but for ours purposes, approximately seven per cent  
19 destruction per decade is what is agreed on by the UK, UBC  
20 and Canada. That is seven per cent lost cells so that 50  
21 years of age you've lost half the neurons and the  
22 substantianigra. There's destruction. There's great  
23 compensation, obviously.

24       Parkinson's Disease occurs when you have 75 to 80 per  
25 cent destruction of those neurons. This is an absolute.

1 But consequently, one of the major theories in leading edge  
2 neuroscience which relate to environment today is that there  
3 are agents, neurotoxins -- insidious neurotoxins like  
4 manganese which are age accelerating neurotoxins.

5 These agents have the ability to speed up the normal  
6 attrition which occurs in the substantianigra. In other  
7 words, instead of seven per cent, perhaps in the womb, in  
8 utero, perhaps peripherantially since manganese attacks  
9 peripherantially developing tissue, that is the fetus and  
10 younger children are peripherantially vulnerable to  
11 manganese, that one would have an accelerated attrition rate  
12 so they may have -- instead of 20 years of age a 21 per cent  
13 destruction, this could be an insult by a toxin -- an age  
14 accelerating toxin -- which would produce like a 10 per  
15 cent. Perhaps at 35 years of age they also have another  
16 insult by another toxin which again produces another  
17 acceleration so consequently, at 50 years of age, they now  
18 have 75 per cent destruction of the substantianigra.

19 Currently, as you can well see, there are no methods  
20 apart from nuclear medicine which can really address what  
21 the rate of destruction is in the substantianigra of any  
22 individual.

23 To my mind this is one of the paramount problems  
24 addressing occupational toxicology and occupational health  
25 risk, the ability to evaluate as can now be done using spec

1        imaging. Single photo ... and computerized tomography.  
2        This is the poor man's PET scanner which allows hospitals  
3        over \$100 thousand, using sophisticated radio pharmaceutical  
4        molecules to determine the degree of destruction in the  
5        substantianigra, to evaluate the age acceleration in any  
6        individual.

7            I believe that manganese is such an age accelerating  
8        neurotoxin and I believe this is the answer to manganese's  
9        ability to produce biochemically, pathologically and  
10       clinically the picture which is very similar -- very  
11       similar, but not identical to Parkinson's Disease.

12           The ... effect which was very peculiar and still is a  
13       mystery is the psychiatric manifestations of this. The more  
14       I worked with manganese, the more I became convinced that  
15       this particular metal could not be toxic. There was no  
16       rational to explain why in 1837 James Couper in Glasgow  
17       examined workers who had been industrially using manganese  
18       oxides, grinding manganese ores and he came out with two  
19       papers in Nature in which he stated that manganese had the  
20       ability to produce in these workers a gait, peculiar  
21       muscular incoordination, psychiatric symptoms and loss of  
22       libido.

23           The three classic symptoms associated with Parkinson's  
24       Disease -- with manganese neurointoxication, that is the  
25       unillogical picture, the psychiatric picture and the

1 reproductive picture.

2 I think manganese is a classic example of ... induced  
3 reproductive disfunction because my studies and other  
4 studies have shown that it will effect the sperm and it does  
5 this, I believe, through its ability to interfere with the  
6 normal neurantican processes.

7 Endogenously it is localized in highest amounts in the  
8 ..., it's an area which controls particular reproductive  
9 hormones like FSH, LH and so on which are used very much in  
10 the maturation of sperm. Again, we go back to this  
11 developmental peripherantially vulnerable aspect of  
12 manganese intoxication.

13 This again to me was intriguing, actually. The fact  
14 that there was an effect on the testes, effect on the basal  
15 ganglia. But it didn't make any sense that why in the brain  
16 would it be present in much greater concentrations in  
17 certain areas like cerebellum and the cortex and in the  
18 basal ganglia and the substantianigra present in only  
19 moderate amounts yet the destruction of this nuclei took  
20 place. What was the answer to this conundrum?

21 We're reared to believe that the firstest with the  
22 mostest and mostest is there is the one that's going to  
23 cause all the damage and everything is predicated on this.

24 Manganese's name again goes back to the original, the  
25 occult origins of this thing and it lives up to it because



1       it does not necessarily, nor does it follow  
2       neurotoxicologically ... occur. This cannot be used.

3               This was inexplicable to me for many years until, like  
4       most things, we look back to the work has been done earlier  
5       on and I came across some work that have been done in  
6       England way back in the early part of the century where this  
7       individual had been administering manganese -- excess  
8       manganese to plants and he found that the leave portion, a  
9       particular portion of the leave exhibited neurosis. It was  
10      brilliant biochemistry for those days, he extracted the  
11      manganese from that particular portion of the leaf which was  
12      intoxicated and he found, to his astonishment, that the  
13      manganese he had given which was manganese 2 which exhibits  
14      a number of valences, five valences to be precise, that the  
15      manganese he extracted from the leaf was, in fact, manganese  
16      trivalent,  $Mn^{3+}$ , and yet he'd administered  $Mn^{2+}$ .

17             This, to me, was a major clue, I feel an unraveling as  
18      to what manganese was doing in the brain and explaining why  
19      manganese was only localizing to a very tiny area of the  
20      brain. I considered that you get huge amounts of manganese  
21      and very little happens, perhaps the basal ganglia, the  
22      substantianigra presented manganese with the unique  
23      environmental biochemical milieu by which it could be  
24      oxidized to a higher valence form, that manganese in fact  
25      living up to its name, manganese and voo-doo, was, in fact,

1 exhibiting the faces of Janus. One side malign and one side  
2 benign.

3 The Mn<sup>2</sup> form, as we know it, a ubiquitous metal, benign  
4 metal. It has all sorts of good things and the more I know  
5 about manganese, which is not very much, which is derived, I  
6 can assure you, from the gifted work which has been done by  
7 Cortzias and others long, long before, frankly I think that  
8 the ability of manganese to induce insult is due to its  
9 ability to be escalated to the higher valency form.

10 This theory falls with a number of papers and it has  
11 since been confirmed by other workers, particularly Dr.  
12 Archibald.

13 So that my theory actually tells of manganese  
14 neurointoxication is you have to address it in those terms.  
15 It's ability to be escalated to higher valency forms and  
16 when one talks to toxicity you have to look and ensure that  
17 it's actually the trivalent form in fact that you're looking  
18 at.

19 This would explain as to why manganese localizes and  
20 attacks specifically a nucleus. A nucleus which contains  
21 the brain's highest content of peroxidase, which has the  
22 ability to oxidize manganese, is the highest content also of  
23 lipid peroxides, ... fatty acids and also this whole milieu  
24 which is contained in that region provides the necessary  
25 environment in which manganese trioxide -- manganese --

1        trivalent manganese can actually flourish and do its damage  
2        to that particular region.

3                In terms of the psychiatric effects of manganese, I  
4        believe that the trivalent form is able to alter the binding  
5        of the ... neurotransmitter, dopamine neurotransmitter in  
6        the putamen, in the basal ganglia. This would occur -- this  
7        is the peculiar thing, why does acute phase in miners. We  
8        have this acute phase, this psychiatric problems which  
9        disappear and then they come down with Parkinson's Disease.

10               The acute phase only lasted about six months, according  
11        to George, and this is explicable in the fact I consider  
12        where you're getting escalation and de-escalation between  
13        the various valence states of manganese and manganese three  
14        form or perhaps even manganese four form has the ability to  
15        block the binding of the ... dopamine receptor in the basal  
16        ganglia and this has been considered possibly involve --  
17        this particular receptor, in psychiatric disturbances and  
18        schizophrenia. This has yet to be addressed.

19               The effects of manganese on the reproductive system  
20        would act actually similarly, through the neuroendocrine  
21        nucleus ... and the hypothalamus. Again a specific  
22        localized nucleus.

23               All of these nuclei have the ability for very, very  
24        high energy. These are areas where maximum energy, maximum  
25        oxygen consumption is taking place. Manganese toxicity

1 occurs not because of access in that sense but because of  
2 paratervation of the normal physiological role which is  
3 undertaken by manganese. That's a story we cannot go into  
4 here but like most things we find as we enter and look at  
5 nature and biology, we find that how incredible it is is  
6 that metal ions, actually, and things which would serve a  
7 physiological function, when we see the toxicity, it's only  
8 within a very narrow range at very tiny amounts, like  
9 selenium. A doubling of selenium produces profound  
10 neurotoxicity. So again manganese exhibits a similar sort  
11 of thing.

12 There are exacerbating factors, also. Iron deficiency  
13 will produce pronounced manganese toxicity. Calcium  
14 deficiency likewise. These metal ions seem to act as  
15 gatekeepers in holding off the -- in holding down the  
16 escalation of manganese to the higher valency toxic species.

17 I was intrigued a couple of years ago in manganese  
18 study, a call to go to Australia where there's an island  
19 called Groote Eylandt discovered by the Portuguese some  
20 years ago at the northern territory of Australia and the  
21 individual there, Dr. Cawte who is a transcultural  
22 neuropsychiatrist who did work with the aborigines for many  
23 years and he was surprised to find that there was  
24 considerable violence exhibited among the aborigines in this  
25 region. This very remote region. Also, I was intrigued

1 with the fact that he mentioned that Groote Eylandt  
2 contained the site of the world's largest manganese mine,  
3 owned by BHP Associates in Melbourne, Australia.

4 But most importantly, I was extremely intrigued when I  
5 looked at the map of the location. The basic neuroscientist  
6 depends on the epidemiologist to give them clues as to what  
7 -- where diseases are occurring and where there is a ... of  
8 these diseases. This applies also to neurodegenerative  
9 diseases.

10 One of the things Dr. Cawte has been working on and ...  
11 and others in the NIH for many years is the prevalence  
12 within the South Pacific of Alzheimer's Dementia,  
13 Parkinson's Dementia and ALS or Amyotrophic Lateral Sclerosis.

14 This has been localized, clusters of cases in the key  
15 peninsula in Japan and the Island of Guam and Southwest New  
16 Guinea. They have clusters of these cases and they have  
17 looked at the environment, there has been a number of  
18 possibilities put forward. One has been manganese and one  
19 has been aluminum in the soil. But the interesting thing  
20 about all these areas, actually, is there's a calcium  
21 deficiency in all the regions.

22 So when I looked at the map I was delighted to find  
23 Groote Eylandt -- this lay 200 miles actually further south  
24 of New Guinea and if one drew a line between the key  
25 peninsula between Guam, between Southwest New Guinea and

1       between the Island -- Groote Eylandt -- it runs 137 degrees  
2       longitude, which is quite staggering.

3               When I was on Groote Eylandt I had an analysis done of  
4       the water. I swam in the river water where I stayed and  
5       this was -- what really astonished me was how soft the water  
6       was and there is virtually no calcium in the water. The  
7       other water was the same. There was no calcium in the  
8       water. For us, in this part of the world, this is quite  
9       staggering to find water which doesn't have any calcium or  
10      magnesium salts in it.

11             Under those conditions, this renders manganese  
12      particularly toxic. As I've mentioned earlier, the lack of  
13      calcium which acts as an ion antagonist, occluding and  
14      keeping manganese under control, controlling its valence.  
15      So this is very significant in all these areas.

16             This is obviously an area of great interest in terms of  
17      the neurological symptoms that were occurring in the  
18      aborigines. It's a difficult area because this area is not  
19      open to Australians, it's run by the aborigines themselves  
20      but Dr. Cawte has access to the area because he's a member  
21      of the community, having worked with the aborigines for many  
22      years.

23             The area, I found recently, to my astonishment, again  
24      lending credence to the occult origins of manganese, I just  
25      recently received from the Australia National Library the

1 log of Captain John Flinders who mocked ... the british  
2 navigator who was sailing the HMS Beagle, the same ship  
3 which was used by Darwin to devise his theories on the  
4 origin of the species. The HMS Beagle travelled all around  
5 Australia and the thing in the log which is most intriguing  
6 is that he remarks on the aborigines in Australia very  
7 greatly.

8 He came to an area which he, because of the presence of  
9 these enormous nodules he called Blue Mud Bay. Blue Mud Bay  
10 is very close to the site where BHP has it's manganese  
11 mines. Blue Mud Bay, of course, refers to the manganese  
12 nodules. An area of enormous deposits of manganese.

13 In his log he recalls also that unlike other islands  
14 close by, within 50 to 85 miles, the natives of Groote  
15 Eylandt and Blue Mud Bay had sent their wives and children  
16 away and exhibited hostile behavior and aggressive behavior.

17 This I thought very intriguing, actually, since this  
18 was 1805 and -- through 1837. Very, very interesting point  
19 and so when Mr. Hodges actually had called me regarding the  
20 ... nature of manganese in relation to violence, I was very  
21 intrigued.

22 Studies are progressing, actually, on Groote Eylandt  
23 and much more work is needed to determine in fact does  
24 manganese have the ability to produce a violent state. I  
25 have no conception of whether this could be done or not but

1       it's a very interesting problem.

2               Again, we have with manganese all these associations  
3       and like most things, the research needs of this remarkable  
4       ... have never really been addressed.

5               In relation to Ethyl Corporation and their submission  
6       today, frankly, I'm mad and this is the reason I'm here.  
7       I'm mad because they have had ample time to address the  
8       research problems in this area.

9               I was asked to meet and to write about the health  
10       effects of manganese, essentially in minuscule form I  
11       published in that paper, in that document essentially more  
12       or less what I've told you this morning.

13               That is, the ability to look at manganese intoxication  
14       from this insidious viewpoint as a neurotoxin. It has the  
15       ability to escalate through several valence states. The  
16       aerosol route is the most profound neurotoxic route.

17               The possibility that it may be involved in alteration  
18       -- in altering neurotransmitter binding in the central  
19       nervous system. The most important priority, of course, is  
20       to establish in primates whether, in fact, manganese is an  
21       age accelerating neurotoxin and to me this is the pivotal  
22       problem in relation to manganese.

23               I discussed these with a representative from Ethyl  
24       Corporation no less than four years ago. Ethyl Corporation  
25       were also given a copy of the Health Effects document which



1 has been published so they could make and address these  
2 possibilities.

3 I've seen the document which has been delivered to the  
4 EPA in reference to their submission to support their  
5 waiver. I find this document specious for a number of  
6 reasons.

7 They use old data, it's filled with essentially utopian  
8 rhetoric which does not really address anything. It puts on  
9 blinkers. People are sitting there and they refuse in a  
10 paranoid way to see anything beyond what is favorable and  
11 what is utopian in relation to their particular case.

12 It's not just that manganese is an insidious  
13 neurotoxin, the fact is that manganese is representative of  
14 a number of other neurotoxins and as such should be  
15 addressed by your body in this regard.

16 Your body should be cognizant of the fact that we now  
17 have new class toxins which threaten health on the long term  
18 basis. These problems are fraught, obviously, with great  
19 technical difficulties but they're not insurmountable and  
20 EPA has surmounted greater difficulties in the past, I  
21 believe.

22 I believe this is a challenge to your organization. I  
23 think it's incumbent on your organization to ensure that  
24 this research is conducted so that 20 years along the line  
25 we're not looking back and saying of course, these are age

1 accelerating toxins. This is essentially why this thing  
2 occurred. Because we released these into the atmosphere, we  
3 did not address the possibility that there was different  
4 oxidation states which could cause different problems in the  
5 selective nucleus in the central nervous system. Despite  
6 the fact that one has a thousand times greater  
7 concentrations. There are premises which are set,  
8 obviously, in scientifically valid data, do not necessarily  
9 follow in all cases.

10 I challenge you gentlemen that manganese lives up to  
11 its occult origins and this should be taken to you as a  
12 challenge, to ask Ethyl Corporation to conduct this  
13 research, to have it conducted in good establishments by  
14 reputable individuals. That's all I ask and that's why I'm  
15 here today. Thank you.

16 CHAIRMAN WILSON: Thank you very much. Could you  
17 give us the status of what the reaction was to this document  
18 within your country, Canada, and what the status of using  
19 MMT and the experience has been?

20 DR. DONALDSON: Not only is manganese a stealth  
21 neurotoxin but I think also the political economic abilities  
22 in which manganese is marketed also rubs off on particular  
23 individuals marketing it.

24 I have -- I'm frankly astonished, actually, but  
25 frankly, Canada does not have the neurotoxicology back up to

1 address the problems which I've already pointed out to the  
2 Canadian government.

3 They consider that these are valid problems but in  
4 terms of neurotoxological evaluation of the issues which I  
5 have raised, they're technically incapable of doing this at  
6 present.

7 They have also, like our individuals, they have used  
8 the data -- previous data conducted by the World Health  
9 Organization and others to come to their conclusions on  
10 this. But as I mentioned to you this morning and I hope I  
11 made this point across, you cannot see manganese  
12 neurointoxication without also being cognizant of  
13 neurodegenerative diseases like ALS, like Alzheimer's and  
14 like Parkinson's Disease and being aware of leading edge  
15 achievements in neuroscience and this is the way manganese  
16 has to be addressed. We don't have the personnel or the  
17 technical capacity for that.

18 MR. POIRIER: Dr. Donaldson, in item number four  
19 and also the item number seven you included some hair  
20 analyses and you said that statistically analyzed and you  
21 found that manganese was pulled out as the sole element  
22 causing these violent behaviors.

23 What kind of statistical analysis was performed and --  
24 because just doing a cursory look over some of these profits  
25 I also see significant increases in a lot of the heavy

1 metals and I was wondering also if this has strictly been on  
2 hair analysis or whether or not it's been correlated to what  
3 levels of the various heavy metals or minerals.

4 MR. HODGES: To answer that, first of all, there  
5 are four or five different articles with regard to blood  
6 manganese because -- that conflict with other -- because  
7 they're talking about 15 parts per billion in normal blood  
8 serum manganese and it's tough to get something to correlate  
9 so that there's never been, to my knowledge, a competent  
10 double blind study taking blood manganese and hair and  
11 seeing if there's a relationship.

12 We are playing around right now on a mini study to  
13 verify whether or not we have the super oxide dismutases.  
14 I'm beginning to sound like John Donaldson here. Protein  
15 marker in here relative to blood.

16 We've got 10 samples of violent kids out of California  
17 Youth Authority. Four of them had elevated manganese. They  
18 are 17, 18 years of age. We're taking the urine and the  
19 blood and the hair and seeing if we can find the specific  
20 protein marker in the hair that would confirm and relate to  
21 elevated manganese.

22 If we have it, then the argument with regard to the  
23 viability and the integrity of using hair analysis is all  
24 over because the entire medical profession -- if you can get  
25 the one protein marker that's in the hair, then we've got a

1 marker but right now hair analysis has had a bunch of bad  
2 press but we now have Dr. Gottchalk, Dr. ... who is on the  
3 National Institutes of Health as one of the co-authors on  
4 the paper that has been submitted to the Journal of  
5 Neurotoxicology. Hopefully it's going to get published  
6 someplace in the next few months.

7 This will be the first time where there's been  
8 extensive in four different institutions, all double  
9 blinded, something to relate to a physiological marker for  
10 violence.

11 If we know what the problem is with regard to this  
12 criminal justice problem or at least, let's say 50 per cent  
13 of the people, then we can start attacking what it is that  
14 these people need that have the propensity to gather up the  
15 heavy manganese, lead and so on.

16 Manganese is the only element that we could find in all  
17 of these institutions that was consistently over one  
18 standard deviation high. Lead would be at one institution  
19 and not in the next. Cadmium -- we got air samples on 12  
20 serial murderers. I mean, bad, bad hombres. Eight of these  
21 10 guys have extreme imbalances.

22 Simonson in Missouri that killed his family. Way off  
23 the way with regard to sodium and potassium but his  
24 manganese and lead and cadmium were okay.

25 Hubertey who murdered the 21 kids at the McDonalds

1 hamburger stand in San Jacinto five years ago, the highest  
2 lead cadmium of 100 thousand hair samples that were in the  
3 computer.

4 Hubertey -- the reason I went after Purdy was because  
5 Purdy was also a welder. Hubertey was a welder. Shot guns  
6 down in his basement that was unventilated. Got the hair  
7 sample. Extremely high lead and cadmium.

8 We went to Purdy because I heard Purdy, who shot and  
9 killed -- I think it was six children in a grammar school --  
10 was also a welder and loved guns and I predicted he'd have  
11 high lead and cadmium and no manganese. He had high cadmium  
12 but he had 2. plus standard deviations of manganese.

13 So you know, my area over here is violence. I had  
14 another kid that graduated with honors at Davis in political  
15 science and he was attacked by some violent guy, fractured  
16 his skull, broke his nose, knocked his teeth out, he's got  
17 permanent brain injury for the rest of his life. So I have  
18 a real, sincere interest in doing something on the violent  
19 side.

20 Donaldson is over here working with and has worked in  
21 15, 20 years either on the neurodegenerative effects of  
22 manganese. My hot flash is that the quicker the National  
23 Institute of Justice who now has a submittal because of a  
24 law passed in California for 600 kids to go under a double  
25 blind study is to get the hell out of the criminal justice

1 business and go back and try to drill some oil wells. But  
2 right now there's nobody taking on the battle.

3 You've got to go out there -- dealing with a  
4 bureaucracy is really an experience, I'll tell you that. I  
5 have been laid, relayed and parlayed by the bureaucracy as a  
6 scientist but since I don't work for them, I'm not on the  
7 payroll, they can't fire me, I'm having the time of my life.

8 MR. POIRIER: I have a question for Dr. Donaldson.  
9 In the past 10 years manganese additives have been used in  
10 Canada. Are you aware of increases in ambient levels of the  
11 tri or tetroxide forms of manganese in air, water, soil,  
12 dust and if so, is there any epidemiological evidence that  
13 has shown any increases in Parkinsonism or any of the other  
14 neurodegenerative diseases that might be correlated to these  
15 increases if they are there?

16 DR. DONALDSON: That's an excellent question, once  
17 which actually would be addressed in the United States,  
18 actually. We live in a very sparse country, as you know.  
19 We're a tiny population, we're clustered along, actually,  
20 200 miles north of the border and we have an area of almost  
21 4 million square miles. So in terms of area, this sort of  
22 things would not be feasible within our own geographical --

23 MR. POIRIER: Not even in your cities? This work  
24 is not that --

25 DR. DONALDSON: Oh, there are monitoring --

1 manganese actually is monitored in the cities, particularly  
2 Ontario, actually. They have a number of scientists. The  
3 putative relationship between metals and neurological  
4 diseases is a problem that still remains to be addressed and  
5 one severe hinderance to this is acquiring personnel that  
6 have the interest and secondly, people that are really  
7 thoroughly qualified. Good neuroscientists to really  
8 address these problems and these types of individuals are  
9 not available within our government's service,  
10 unfortunately.

11 MR. POIRIER: The down shot is that data is not  
12 available to us at?

13 DR. DONALDSON: Yea, I'm afraid so.

14 MS. GILHOOLEY: I have a question for Dr.  
15 Donaldson about this paper number six that's in the package  
16 about manganese in the Canadian Environment, Associate  
17 Committee on Scientific Criteria for Environmental Quality  
18 of the National Research Council. Is this a report to that  
19 associate committee or did the associate committee adopt it?

20 DR. DONALDSON: This was adopted by the associate  
21 committee, of which I was a member and submitted to the  
22 Canadian government, actually, and I'd say we hopefully will  
23 see some action on it sometime.

24 I might actually add, within that document we've been  
25 discussing health effects, actually. The other members of



1 this committee, of which I was a member, were geologists and  
2 fish biologists and all types of individuals concerned with  
3 the environmental implications of manganese.

4 For example, it alters particularly the fish stocks in  
5 certain areas. It effects ... These things were addressed  
6 by my colleagues, actually, and are contained also within  
7 that document so it's not just health effects we're looking  
8 at, specifically.

9 MR. POIRIER: Dr. Donaldson, you earlier mentioned  
10 the earlier study done in which manganese dioxide was  
11 administered and you were able to extract a trioxide in  
12 you're potentially saying that the trioxide form is the  
13 neurotoxic form.

14 Are you aware of what effects, if any, the tetroxide  
15 form would have, is it similar to the trioxide or is it  
16 metabolized back to a trioxide, what is the chemistry with  
17 the tetroxide form of manganese?

18 DR. DONALDSON: Excellent question, actually.  
19 Excellent question. I arrived at this -- serendipity plays  
20 an enormous part and the same thing in this. This all  
21 occurred because of a faulty pH mirror, okay, 7.4, the  
22 standard procedure is used. This pH mirror was reading  
23 actually 8.2. The solutions were all 8.2.

24 I didn't understand it when I gave it to a graduate  
25 student to repeat his experiments, try the effects of

1 manganese on dopamine, and she didn't have any effect.

2 The experiments I had conducted, when I added manganese  
3 to dopamine solutions buffered at 7.4, my god, the dopamine  
4 was broken down in seconds and tremendous oxidation took  
5 place. Dose dependently when I add manganese. Even by as  
6 much -- as little as half a micromolar.

7 So I was incredulous when she could not repeat this.  
8 So I repeated it all and low and behold, it didn't work. So  
9 I was baffled at this and I sat down for about a week to try  
10 and figure it out.

11 I came to the conclusion that my colleagues pH mirror  
12 was on the blink. I went over there, he changed the  
13 situation and it had been reading, actually, about .7 to .8  
14 units higher, actually -- or lower than I had been using.

15 So wasn't that strange? And then I looked into the  
16 physical chemistry and I find actually in alkaline solutions  
17 the predominant form of manganese is Mn3 and the pH I was  
18 using was 100 per cent so I had 100 per cent Mn3 Oh.  
19 Manganese hydroxide. Which caused a tremendous breakdown of  
20 the dopamine but normally it didn't really work very well or  
21 very, very slowly.

22 So this is when I got the idea of the trivalence form  
23 being the toxic form. I went back, as one does, to the old  
24 literature. What is buried there but we failed to see it.  
25 We don't look at it because we -- I'm talking myself -- we

1 have said we're looking for a definite theory and we find,  
2 my god, there it is there, way back in -- George Cotzias had  
3 mentioned this, the gifted pioneer of research on manganese  
4 neurotoxicity. He mentions it way back in the '50's.

5 His association with melanin and it's different -- it's  
6 ability to go to higher ... species and the possibility that  
7 maybe there would be a difference in the toxicity. This was  
8 left -- that took me into an area which I knew about but  
9 again, serendipity, a colleague had visited Dr. Petkas from  
10 the Atomic Energy Center who was an M.D. and a physicist and  
11 he taught be about free radicals.

12 I thought free radicals were refugees from Berkeley  
13 campus or something but free radicals are fascinating  
14 molecules which actually are produced and which we're now  
15 beginning to learn a little bit about and manganese, when it  
16 hits on dopamine, not only breaks the dopamine down but also  
17 releases large amounts of free radicals like the hydroxyl  
18 radical, an extreme super toxin. These are major toxins,  
19 actually propagated by manganese when it reacts with  
20 dopamine.

21 What is remarkable also is that manganese doesn't only  
22 produce these profound free radical toxins but it also has  
23 the ability to completely break down the normal neuronal  
24 defenses like GSA, glutathionine. They oxidize  
25 glutathionine as well, so it's a double whammy. It doesn't

1       only break down dopamine but it produces toxins which  
2       completely break down the whole neuronal defense system for  
3       free radicals so it's quite a remarkable thing, actually.

4               To answer your question, actually, I think it may have  
5       four forms and these should be looked at. I had mentioned  
6       in my papers three or four and it turns out people -- the  
7       physical chemists have done all this work and it's Mn3,  
8       actually, which does all the damage.

9               CHAIRMAN WILSON: I think that's all the  
10       questions. Thank you both very much for coming to see us.  
11       We're going to take about a five, ten minute break and then  
12       we'll have Ethyl Corporation.

13               (A brief recess was taken.)

14               CHAIRMAN WILSON: The last witness today is the  
15       Ethyl Corporation.

16               MR. WILKINS: Good morning. My name is Ray  
17       Wilkins. I'm a Senior Vice President of the Ethyl  
18       Corporation and President of Ethyl's Chemical Group.

19               I'm here today to speak in support of our waiver  
20       application for Hi Tec 3000. With me today on the panel are  
21       Dr. Gary Ter Haar, Ethyl's Corporate Vice President for  
22       Health and Environment and F. William Brownell of Hunton &  
23       Williams, our counsel.

24               Also present to assist us in answering questions  
25       regarding our application are members of our technical staff

1 and the independent consultants who analyzed our test data.

2 Our goal today is to provide a brief overview of the  
3 test program and analyses are described in detail in our  
4 waiver application documents and to answer questions  
5 concerning our waiver application. I recognize that it may  
6 be appropriate to respond more fully to some questions in  
7 writing after the hearing.

8 By way of summary, Hi Tec 3000 is an environmentally  
9 safe octane improver developed by Ethyl scientists. Our  
10 extensive tests show that the use of our product not only  
11 boosts octane but also reduces the level of regulated  
12 tailpipe emissions including a significant reduction in  
13 nitrogen oxides.

14 The additive saves crude oil and allows refiners to  
15 reduce aromatics and fuel vapor pressure. Furthermore, Hi  
16 Tec 3000 is completely compatible with gasoline containing  
17 oxygenates.

18 I will now continue with a description of the additive  
19 and an overview of our test program. As I've already  
20 indicated, the additive is a manganese based octane  
21 improver. The addition of about one-half teaspoon of the  
22 additive in a 20 gallon tank of gasoline improves the octane  
23 number of the gasoline by about one octane number.

24 This increase is achieved at approximately one-third  
25 the cost of the current available alternatives for enhancing

1 octane. Twice before Ethyl has sought EPA's approval to use  
2 the additive in unleaded gasoline.

3 Although EPA denied these requests due to insufficient  
4 supporting data, in both cases the EPA invited Ethyl to  
5 reapply for a waiver whenever adequate data on the effects  
6 of the additive on emission control systems were developed.

7 Since the completion of these two waiver application  
8 proceedings almost a decade ago, several hundred billion  
9 miles of vehicle service have been accumulated in Canada on  
10 gasoline containing the additive.

11 Moreover, we have completed a carefully designed test  
12 program in the United States. We believe that the time is  
13 now right for broad use of the additive in unleaded gasoline  
14 in the United States.

15 For this reason, Ethyl has filed a new waiver  
16 application to allow use of the additive in a concentration  
17 not to exceed 1/32nd of a gram of manganese as Hi Tec 3000  
18 per gallon of unleaded gasoline.

19 To obtain a waiver for use of the additive, Ethyl must  
20 show that the additive will not cause or contribute to a  
21 failure of any emission control device or system to meet the  
22 emission standards for which vehicles are certified under  
23 the Clean Air Act.

24 To meet this requirement Ethyl has conducted the most  
25 extensive series of vehicle emission and other tests ever

1     undertaken by a private company. This test program was  
2     designed in consultation with both the automobile companies  
3     and EPA staff.

4             This test program involved 48 cars operated for a total  
5     of more than 3 million miles. Half of the cars used a test  
6     fuel containing the additive and half used the same test  
7     fuel without the additive. At each 5 thousand mile  
8     increment independent laboratories measured the tailpipe  
9     emissions from each vehicle to determine what effect, if  
10    any, the additive had on tailpipe emissions.

11            These data were then subjected to rigorous independent  
12    statistical analysis in order to evaluate the impact of the  
13    additive over 75 thousand miles of vehicle operation. These  
14    analyses show that the additive substantially reduces  
15    emissions of hydrogen oxides while also reducing emissions  
16    of carbon monoxide.

17            The reductions in NOx emissions are illustrated in this  
18    chart. You will note that the reductions in Nox emissions  
19    associated with use of the additive begin almost  
20    immediately.

21            Chart two illustrates the overall reductions in carbon  
22    monoxide emissions. The reductions in carbon monoxide  
23    emissions begin to appear at about 25 thousand miles and  
24    become more pronounced thereafter.

25            These reductions for NOx and carbon monoxide and

1 continue and indeed increase in magnitude as milage  
2 accumulation increases.

3 The NOx and CO emissions reductions result from two  
4 beneficial effects of the additive. First, the additive  
5 reduces engine out NOx and carbon monoxide emissions.  
6 Second, manganese oxide acts as a catalyst, making the  
7 converter and other components of the emission control  
8 system more efficient in removing nitrogen oxide.

9 This NOx effect is addressed in a paper prepared by Dr.  
10 Roy Harrison of the University of Lancaster, England and Dr.  
11 Harry Edwards with Colorado State University which is part  
12 of Appendix 9 to the waiver application. We plan to submit  
13 additional information on this issue for the record in our  
14 written comments after the hearing.

15 You should also note that these reductions in NOx and  
16 carbon monoxide emissions occur without a material change in  
17 hydrocarbon emissions.

18 Chart three illustrates the overall effect of the  
19 additive on hydrocarbon emissions. The independent  
20 statistical analyses performed by Systems Applications,  
21 Incorporated and Roberson Pitts, Incorporated show a close  
22 correspondence between hydrocarbon emissions for cars using  
23 the additive and cars using clear fuel.

24 Indeed, according to these analyses, the only  
25 statistically discernable change in emissions associated



1 with use of the additive occurs within the first 5 thousand  
2 miles of vehicle operation. This is a very small change, an  
3 increase of only .017 grams per mile. At 50 thousand miles  
4 no additional statistically discernable change in  
5 hydrocarbon emissions is observed.

6 Chart four illustrates the average differences in  
7 emissions between the clear and additive fuel vehicles for  
8 each of the three pollutants. As the statistical analyses  
9 of these data show, the very small increase in hydrocarbon  
10 emissions will not cause or contribute to the failure of  
11 emission control systems to meet emission standards. Either  
12 existing standards or those that may result from proposed  
13 legislation.

14 Even the very small emissions increase observed in the  
15 test program should not occur in commercial operations as  
16 refineries use the additive in place of aromatics in  
17 unleaded gasoline.

18 By comparison, EPA has granted other recent fuel  
19 additive waivers even though emissions of one pollutant  
20 clearly increased, as long as overall emissions decreased.

21 The very small increase in hydrocarbon emissions  
22 observed in the test program therefore is not a reason for  
23 concern with respect to our application.

24 As pages 46 to 56 of the waiver application and  
25 Appendix 10, we provide a full explanation of why the slight

1 hydrocarbon emission increase is unimportant as a practical  
2 matter. I urge you to closely review these materials.

3 In addition, Shep Burton of SAI and Ralph Roberson of  
4 RPI, the independent consultants responsible for the  
5 statistical analyses of the data, are available to answer  
6 your questions regarding their analyses.

7 In sum, Ethyl has met the statutory standard.  
8 Moreover, based on the results of Ethyl's test program,  
9 total emissions in cars using the additive, including  
10 reduction in noxious pollution such as benzene and  
11 formaldehyde could be reduced by up to 1.7 billion pounds  
12 per year by 1999. These reductions are summarized in Chart  
13 5.

14 In addition to tailpipe emission testing, Ethyl also  
15 conducted extensive testing to determine what impact, if  
16 any, use of the additive has on the materials used in  
17 automotive emission control systems.

18 This testing shows that the additive will not cause  
19 plugging of catalytic converters. In fact, Ethyl testing  
20 shows that catalytic converter efficiencies were actually  
21 improved by the presence of the additive in the fuel.

22 These results are summarized in this chart. The chart  
23 shows the average loss in converter efficiency for the clear  
24 and additive fuel test vehicles. Ethyl's testing also shows  
25 that use of the additive will not adversely effect the

1 operation of oxygen sensors or materials used in the  
2 automotive fuel system.

3 Indeed, Petro-Canada, Incorporated, referring to the  
4 preliminary results of a study it commissioned to  
5 investigate whether the additive causes plugging recently  
6 observed that automobiles in Canada using fuel containing Hi  
7 Tec 3000, up to twice the concentration requested in this  
8 waiver application, have shown no signs of catalyst plugging  
9 after almost 100 thousand miles of vehicle operation.

10 Of particular note, the preliminary results of this  
11 study shows that the catalyst with the highest manganese  
12 level had the best performance in terms of emissions.

13 A copy of a letter to the editor of Octane Week from  
14 which this information was derived is available for your  
15 review.

16 Our test program further confirms that there is no  
17 cause for concern with catalyst plugging or engine deposits.  
18 Appendix 3 and pages 33 to 37 of the waiver application  
19 present a more detailed explanation as to why these concerns  
20 are unfounded.

21 In light of the on-going efforts to reformulate  
22 gasoline to reduce automobile emissions, Ethyl has also  
23 conducted a series of tests to confirm the compatibility of  
24 Hi Tec 3000 with reformulated fuels.

25 In one of these tests we examined whether use of the

1 additive with a wide variety of fuel blends containing  
2 ethanol, MTBE and methanol would adversely effect automotive  
3 materials. We found that it would not.

4 In a second set of tests we examined the octane  
5 effectiveness of Hi Tec 3000 in this same variety of fuel  
6 blends. We found that the additive compliments the octane  
7 improving characteristics of other additives such as MTBE.  
8 These results are summarized in Chart 7.

9 This means that Hi Tec 3000 can be used to reduce the  
10 aromatic content of reformulated gasoline without  
11 sacrificing octane and thereby further reducing emissions of  
12 both criteria pollutants and other pollutants such as  
13 benzene and formaldehyde.

14 In a third series of tests we examined more directly  
15 the emissions effect of using the additive in a reformulated  
16 fuel containing five per cent MTBE. This testing confirms  
17 that the additive will reduce significantly NOx emissions,  
18 will reduce the aromatic content of hydrocarbon emissions  
19 and will reduce carbon monoxide emissions.

20 The hydrocarbon emission results are of particular  
21 interest. While total hydrocarbon emissions remained about  
22 the same, the reactivity of those hydrocarbon emissions  
23 decreased with use of the additive.

24 Testing of other fuel blends show similar results. We  
25 will submit further information on this issue in our post

1 hearing comments.

2 Use of the additive by refiners will also reduce butane  
3 production, the supply of which will be in surplus under new  
4 Reed Vapor Pressure regulations. With reduced butane, lower  
5 vapor pressure specifications for gasoline are more easily  
6 attained and evaporative or running losses from vehicles in  
7 hot weather can be reduced.

8 In sum, the additive is compatible with a wide variety  
9 of fuel blends and the emission reductions made possible by  
10 the use of the additive will compliment the emissions  
11 reductions made possible by the use of reformulated  
12 gasolines such as oxygenated fuels.

13 Use of the additive will allow refineries to operate  
14 under less severe conditions. As a direct consequence,  
15 crude oil imports could be reduced by about 30 million  
16 barrels per year. At \$18 per barrel, this savings would  
17 amount to a reduction in imports of nearly \$540 million per  
18 year and would be more than the amount of oil stored  
19 annually in the Strategic Petroleum Reserve.

20 Finally, I would like to emphasize that use of the  
21 additive will have a positive environmental effect. As I  
22 discussed earlier, the use of the additive will result in  
23 substantial reductions in automobile exhaust emissions of  
24 both criteria pollutants and aromatics.

25 Use of the additive will also reduce the emissions of

1 pollutants from refineries because use of the additive  
2 allows refineries to operate under less severe conditions.

3 These reduced levels of automotive and refinery  
4 emissions would of course translate into lower ambient  
5 concentrations of pollution and reduce population exposure  
6 to pollution.

7 In this regard, Ethyl asked SAI to examine the  
8 potential impact of the use of the additive on ambient ozone  
9 concentrations. This analysis shows that modest but  
10 nonetheless meaningful reductions in ambient ozone  
11 concentrations could occur in some cities.

12 In Philadelphia, for example, the reduction in ambient  
13 ozone concentrations would be the same as that achieved by  
14 removing approximately 170 thousand cars from the streets of  
15 the city.

16 These potential improvements would be the result, at  
17 least in part, of the lower reactivity of automotive  
18 emissions attributable to the use of the additive.

19 It should also be emphasized that the manganese  
20 emissions associated with the use of this additive would be  
21 extremely small, on the order of five-one thousands of a  
22 milligram per mile.

23 As a result, the maximum increased ambient  
24 concentrations of manganese resulting from the use of the  
25 additive in a typical urban area such as Philadelphia would

1 be only .001 micrograms per cubic meter, a level nearly too  
2 small to measure.

3 EPA's own health review of manganese, the Health  
4 Assessment Document for Manganese in 1984 concludes that low  
5 level manganese emissions present no health concerns.  
6 Indeed, an even more recent report completed by Health  
7 Effects Institute entitled Potential Health Effects of  
8 Manganese in Emissions from Traffic with Diesel Vehicles  
9 concludes that emissions caused by use of manganese fuel  
10 additives in diesel fuel vehicles present no public health  
11 risk, even at ambient manganese levels far in excess of  
12 those which would result from the use of Hi Tec 3000.

13 The overall effect of the additive on public health  
14 and welfare therefore is positive. It will lead to  
15 substantial reductions in the emissions of regulated  
16 pollutants and in reduced ambient concentrations of these  
17 pollutants and will not cause any perceptible change in  
18 background concentrations of ambient manganese.

19 I would now like Dr. Ter Haar, Ethyl's Corporate Vice  
20 President for Health and Environment, to expand briefly on  
21 my remarks concerning public health.

22 DR. TER HAAR: Thank you, Ray. Good morning. Use  
23 of Hi Tec 3000 performance additive will result in  
24 infinitesimal addition emissions of manganese. As you can  
25 see from Chart 1, greater than 99.9 per cent of the Hi Tec

1        3000 is burned in the combustion process.

2            The principle combustion product is MN 304. Based on  
3        testing of vehicles in the Ethyl test fleet, a current model  
4        automobile fueled on gasoline with the additive would  
5        release about .06 grams of manganese to the ambient air on  
6        an annual basis or only about 0.5 grams of manganese over  
7        the course of 100 thousand miles of vehicle operation.

8            Chart 2 depicts the mean results of particular emission  
9        testing on several of the test vehicles used in the Ethyl  
10       test program. You can see from this chart that on the  
11       average only about .4 per cent of the manganese added to the  
12       fuel is emitted to ambient air and that is inorganic  
13       manganese.

14           As a result of these exceedingly small emissions, the  
15       additive will have virtually no impact on ambient  
16       concentrations of manganese. For example, in a typical  
17       urban area like Philadelphia, one could expect  
18       conservatively maximum increased ambient concentrations of  
19       manganese of about only 0.001 micrograms per cubic meter.

20           By way of comparison, EPA has estimated that large  
21       point sources can cause maximum ambient manganese  
22       concentration of over 100 micrograms per cubic meter.

23           Data from the United States National Air Surveillance  
24       Network and from Canada where the additive has been used in  
25       virtually unleaded gasoline for over a decade confirm what



1       these estimates suggest, that the ambient concentrations of  
2       manganese are a function of normal background concentration  
3       in large point sources and that the use of the additive will  
4       have no discernable effect on ambient manganese  
5       concentrations.

6       Chart 3 shows a comparison of airborne manganese levels  
7       in the United States, Canada and the United Kingdom. You  
8       will note that the levels of ambient manganese are very low  
9       and essentially the same in all of these countries.

10       The level of ambient manganese -- the levels of ambient  
11       manganese are comparable even though Hi Tec 3000 has been  
12       and is used extensively in Canada and has never been used in  
13       the United Kingdom.

14       The low ambient concentrations of manganese stand in  
15       sharp contrast to typical soil concentration. Soil  
16       concentrations of manganese are typically over one thousand  
17       parts per million which can be explained by the fact that  
18       manganese is the 12th most abundant element in the earth's  
19       crust.

20       For this reason, manganese is typically found in food  
21       products. In fact, food serves as the largest source of  
22       manganese for man. Chart 4 shows the manganese levels in  
23       several food groups.

24       You can see from this chart that grains and cereals  
25       contain large concentrations of manganese and that one cup

1 of tea may contain as much as 12 hundred micrograms of  
2 manganese. Dietary intake of manganese ranges from two  
3 thousand to nine thousand micrograms per day, averaging  
4 about three thousand micrograms.

5 This daily intake accounts for an excess of 99 per cent  
6 of the amount of manganese absorbed by the body. Chart 5  
7 shows that approximately three to four per cent of the  
8 average daily intake is absorbed from the intestinal tract.  
9 This results in a typical daily uptake of 120 micrograms  
10 from dietary sources.

11 The contribution from inhalation is minuscule in  
12 comparison, only 0.4 micrograms are absorbed daily by  
13 inhalation. Since the use of Hi Tec 3000 will result in  
14 only 0.5 grams of manganese being emitted over a -- from a  
15 single automobile over the course of 100 thousand miles,  
16 typical ambient manganese concentrations will not change  
17 measurably.

18 As a result, the amount of manganese absorbed from the  
19 diet is and will continue to be greater than 100 times the  
20 amount absorbed from air. Even if Hi Tec 3000 is used in  
21 all gasoline.

22 It is also important to contrast the small inhalation  
23 uptake with existing occupational exposure limits. These  
24 limits are shown in Chart 6. These occupational exposure  
25 limits have been established to safeguard workers exposed

1 eight hours a day, five days a week for a lifetime from  
2 adverse health effects. They are many orders of magnitude  
3 higher than existing ambient manganese concentrations.

4 It should also be emphasized as Chart 7 shows,  
5 manganese is a biologically essential trace element. It has  
6 been recognized for many years as being present in trace  
7 quantities in the cells of all living organisms. A  
8 deficiency in manganese has been associated with skeletal  
9 abnormalities and ... of the newborn and defects in lipid  
10 and carbohydrate metabolism.

11 Moreover, metabolism is controlled efficiently by the  
12 hemostatic mechanisms so the tissue concentrations are  
13 maintained at stable levels despite large variations of  
14 manganese intake.

15 Indeed, manganese is present, as has been noted earlier  
16 this morning, in most if not all vitamin supplements at  
17 levels of one thousand to ten thousand micrograms.

18 There are those, however, who would suggest that no  
19 amount of manganese, however small, should be added to the  
20 environment. This is a simplistic view that ignores dose  
21 response relationships.

22 All countries, including the United States, who have  
23 evaluated the health effects of low levels of manganese in  
24 the air have concluded there is no health risk from these  
25 levels.

1           These scientists realize that appropriate risk  
2       assessments acknowledge the difference between toxic effects  
3       at very high levels of exposure and beneficial effects at  
4       lower levels from materials such as manganese.

5           They further understand that an increased uptake of  
6       less than one per cent from daily inhalation, when compared  
7       to what is normally absorbed in the diet, poses no health  
8       risk.

9           For example, studies by Canada's Ministry of Health and  
10      Welfare, the Canadian Journal of Standards Board,  
11      Environment Canada and Transport Canada have determined that  
12      the additive has no environmental or health effect. They  
13      have concluded, "Review of available information on  
14      industrial and community exposure to manganese and results  
15      of studies in animals of chronic inhalation of manganese  
16      exhaust products lead to the conclusion there is no evidence  
17      at present to indicate that expected ambient manganese  
18      concentrations would constitute a hazard of human health."

19          A special Royal Society of Canada commission came to a  
20      similar conclusion. "MMT has already been used for eight  
21      years in unleaded gasoline. The additional exposure to  
22      manganese is well within the normal range presented by  
23      dietary variations and is likely to remain so. Couper's  
24      view that the general public has a wide margin of health  
25      safety with respect to the worst case of MMT in gasoline

1 appears to be sound."

2 Finally, in the United States the Environmental  
3 Protection Agency has issued a health assessment documents  
4 concluding that, "Manganese emissions at levels found today  
5 present no public health concerns, even around large point  
6 source emitters such as steel mills and power plants. EPA  
7 concluded that it is determined that present ambient air  
8 concentration of manganese do not pose a significant risk to  
9 public health and that no regulation directed specifically  
10 at manganese is necessary at this time under the Clean Air  
11 Act."

12 In summary, the vast amount of practical experience  
13 from Canadian use of Hi Tec 3000 and the significant body of  
14 knowledge produced in numerous studies all come to the  
15 conclusion that Hi Tec 3000 has no adverse effect on the  
16 environment or on human health. Thank you.

17 MR. WILKINS: Thank you, Gary. Ethyl has  
18 thoroughly and fairly documented in its waiver application  
19 that this additive meets the statutory standard for approval  
20 of a waiver application.

21 This final chart summarizes the results of our test  
22 program. We have shown that Hi Tec 3000 will significantly  
23 reduce the amount of crude oil that's used, it will allow  
24 refiners to operate at less severe conditions and reduce  
25 point source emissions at refineries, it is compatible with

1 all types of gasoline, it has no harmful effect on  
2 catalysts. As a matter of fact, it enhances catalyst  
3 performance.

4 It will cause no health or environmental problem and  
5 probably most important, it will significantly reduce  
6 emissions from automobiles. We therefore encourage your  
7 prompt approval of this application. Thank you for your  
8 attention and we'll be happy to try to answer any questions  
9 you might have.

10 CHAIRMAN WILSON: Thank you very much. I note  
11 your careful preparation includes bringing your own water.  
12 That's one of the advantages of being last, I guess.

13 Mr. Poirier is going to have to leave to catch a plane  
14 so I think I'll let him ask his questions first.

15 MR. POIRIER: What percentage of the manganese  
16 oxide emission is ... oxide form?

17 DR. TER HAAR: The product coming out of the  
18 tailpipe, as far as we can determine from xray diffraction  
19 is predominantly Mn 304. The exact percentage, obviously,  
20 in a complex ... coming out of the tailpipe is hard to  
21 determine precisely but that's our best estimate.

22 MR. POIRIER: In your particle analysis, is most  
23 of the particle, I assume, is in the .2 and the .4 --

24 DR. TER HAAR: That is correct. Of the material  
25 that comes out.

1           MR. POIRIER: In that range there's no further  
2           differentiation of particle size? Is that just one range  
3           that was set aside as a measurement as opposed to .4 and  
4           larger or .2 and lower?

5           DR. TER HAAR: Generally speaking, exhaust product  
6           -- primary products are typically less than a micron in size  
7           and it's difficult to distinguish them as they get smaller  
8           and smaller. The techniques are difficult.

9           MR. POIRIER: Okay. So there's no data to look at  
10          the distribution of the tetroxide form with a particular  
11          particle size?

12          DR. TER HAAR: That has not been done, to my  
13          knowledge.

14          MR. POIRIER: Have you been following up on the  
15          manganese oxide emissions in Canada and looking at increases  
16          in ambient levels both air and water?

17          DR. TER HAAR: We have not looked at water and of  
18          course, if we would do a calculation on the amount that goes  
19          in the air here, the amount from the use of this product is  
20          so infinitesimal that I wouldn't expect to see any  
21          possibility of finding it in the water if I looked for it.

22          The evidence from the data that we showed you is no  
23          discernable effect on the concentrations in the cities in  
24          Canada.

25          MR. POIRIER: Have you attempted to monitor any

1 potential health effects from the manganese tetroxide in the  
2 population in Canada?

3 DR. TER HAAR: No. We have depended on the  
4 scientific bodies who, from the data I showed you, obviously  
5 Canada continues to look. They looked in '78, they looked  
6 again in '84. The United States has been looking at this,  
7 Australia has been looking at this.

8 All of these groups. We have submitted our information  
9 to them. They get information from everyone else who is  
10 interested in that and we have depended on those expert  
11 groups. Obviously, we follow the literature closely but we  
12 depend on those groups to make those judgments.

13 MR. POIRIER: Okay. So you have no intentions or  
14 have not initiated any efforts from Ethyl's point of view to  
15 look at potential health effects of the tetroxides?

16 DR. TER HAAR: We have done extensive studies on  
17 that back in the '70's. Animal studies, high levels. There  
18 are several studies. I'm sure we cite them in our waiver  
19 and we can give you more information on those animal  
20 studies.

21 We have supported a tremendous amount of work on  
22 research and animal studies on manganese oxides. The  
23 material was burned in a flame, just as it would be in a  
24 combustion process and that material introduced directly  
25 into the areas where both primates and rodents were exposed.



1           In addition, the work sponsored by agencies -- not just  
2 Ethyl but government agencies has been done by a University  
3 of New York. It escapes my mind at the moment. Mike  
4 Carlson and his group did the work on that and showed no  
5 effects from those studies.

6           MR. POIRIER: In those studies that you're  
7 referring to, before introducing the combustion product to  
8 the animals, was speciation of the oxide forms undertaken?

9           DR. TER HAAR: I do not remember if we -- the size  
10 was looked at. The size was clearly looked at.

11           MR. POIRIER: The type of oxide was not, is that  
12 correct?

13           DR. TER HAAR: I do not recall. That data would  
14 be in the report.

15           MR. POIRIER: Thank you. I don't have any further  
16 questions.

17           CHAIRMAN WILSON: Do you have comments to make to  
18 other groups or witnesses who had critical comments to make  
19 vis-a-vis the health effects of manganese?

20           MR. WILKINS: I think my comment on recognizing  
21 dose effect, the question that was asked earlier on is it  
22 safe for me to take my vitamins, I think the answer to that  
23 is clearly yes. All evidence is that the body very  
24 effectively controls the biological use of manganese and  
25 that the mainline medical authorities recognize it is

1 essential and of critical importance to just a wide variety  
2 of necessary functions in our body.

3 It's in there because the medical profession and the  
4 government has -- it's in vitamins because the medical  
5 profession and the government has found it to be appropriate  
6 and I think the sense of dose and the concept of the very  
7 minuscule amounts that are present here were missed by the  
8 other responders.

9 CHAIRMAN WILSON: Let we switch subjects, I guess,  
10 a little bit. Can you explain why it is that the additive  
11 results in decreases of carbon monoxide and nitrogen oxide  
12 but does not decrease and in fact seems to increase  
13 hydrocarbon?

14 MR. WILKINS: All right. I can take a shot at  
15 that. We're going to present more data to the -- with our  
16 written comments addressing these issues.

17 When we talk about engine outs, we measure those just  
18 in front of the catalyst and so by that time there has --  
19 the gas has already began to move down the exhaust system.

20 Calculations by Dr. Harrison from England indicate that  
21 the manganese oxide on the surfaces of the exhaust system,  
22 before it reaches the catalyst theoretically are capable of  
23 reducing the nitrogen oxides to nitrogen and oxide. Not  
24 nitrogen and oxygen. And that the engine out, as we see it,  
25 the reduced engine outs are consistent with that

1 observation.

2 Then, furthermore, that same effect continues on the  
3 catalyst surface and so we see an additional increase in  
4 efficiency on the catalyst surface. So I think it's fairly  
5 clear that -- and he has done studies in the laboratory in a  
6 work we'll submit to you showing the same effect without  
7 having an automobile involved.

8 So I think the nitrogen oxide reduction is pretty  
9 clearly a catalytic effect. The same would appear to be  
10 true of the manganese oxide, acting as an oxidation catalyst  
11 on the -- on CO.

12 Again, before the catalyst. There's no effect on the  
13 catalyst one way or another on efficiency as far as CO is  
14 concerned. The positive effect from CO appears to be mostly  
15 in engine out or the effect that's going to take place takes  
16 place in the early part of the system, probably when the  
17 gases are hottest.

18 This is consistent with the data that we see that it's  
19 delayed in time. We need to have enough material on the  
20 surface of the exhaust system so that the oxidative process  
21 can take place.

22 The hydrocarbon emissions are probably due to a slight  
23 increase in engine outs actually coming out of the cylinder  
24 and are not effected by the manganese oxide, does not have a  
25 catalytic effect either in the catalyst or in the exhaust